

MANAGEMENT VIEW

DAMAGES? SUE AND RECOVER? Utility management had been pondering these questions for some time before the Federal judge in Philadelphia meted out fines and sentences to the manufacturing companies and executives judged guilty of illegal marketing practices. But, public reaction to the guilt stigma--felt by the whole industry--called for prompt statements about intentions to act in the situation. Officials of public and private power organizations did reveal plans to study the records and proceed accordingly, probably after weeks or months of investigation in most cases. Of course, regulatory commissions will watch the efforts closely, could possibly bring utility customers into the picture directly (if refunds collected from manufacturers would be considered returnable to consumers, as proposed by Sen. Lehman, R-N.Y.). And, shareholders, too, might intervene--possibly to claim a share of the alleged over-payments. (See stories on pages 42 and 107.)

THE PATTERN OF R&D is broadening in the electrical industry, notes Northern States Power Co. V-P Earl Ewald in a message for the recent conference of Utility Buyers of the NAPA. "Utilities are expending more and more effort on direct research and development, of necessity, because development work is being done well before there is a commercial market for equipment," he explained. (See report on page 42.)

SUPPLIERS AND BUYERS were asked at this same meeting, by Philadelphia Electric's P.A. John Warner, if they are doing enough: "Are we as utility buyers doing all we can in our companies to assist in the acceptance of ideas which can lead to lower capital costs? Are manufacturers realistically pricing standardized, multiple-manufactured items so as to reflect the true price differential between such items and the so-called special non-standard items utilities order?"

ELECTRIC SYSTEM CONSOLIDATION, effected in New England last month, merged

six wholly-owned subsidiaries of the New England Electric System into a seventh, which was renamed Massachusetts Electric Co. In simplifying its corporate structure, the newly formed unit becomes the largest in NEES, with over 300,000 customers and gross revenues running more than \$60-million annually. Top executive of the Worcester company is the ex-Worcester County Elect Co. president, Alfred W. Smith.

NEW PLANS AT BPA, outlined in a policy statement by Administrator Charles F. Luce, implement the goal: to reactivate and expand . . . to achieve maximum development of low-cost Columbia River power. BPA will support Federal government responsibility for multi-purpose projects, completion of dual-purpose reactors.

SALES, REVENUES, EARNINGS--UP: These are the prospects for '61 as the men who work hardest at making 'em rise meet next week in Chicago to compare LBE strategy. More than 1000 utility executives are expected to participate in the EEI Annual Sales Conference March 20-22. (A month before the beginning of '61's second quarter, utility companies had scheduled some \$400-million in new financing in this period for expansion to keep pace with an economy that was sputtering, but still promising.)

IDEAL TV VEHICLE FOR A UTILITY is the way the Union Electric Co. describes its series of 60-minute local spectacles depicting various aspects of St. Louis Life. Says PR Director Walter G. Heren: "Local specials offer us more of the values we look for . . . Unusual, one-of-a-kind programs have a prestige which sets them apart from week-in, week-out programming. Stars such as Vincent Price, Earl Wrightson and Peggy King create public interest in our shows and generate publicity which would be hard to achieve with any other kind of program."

ECONOMIC CLIMATE

A TURNING POINT in the economic downswing is in the offing, but it is difficult to pinpoint the resumption of growth. Though there seems to be good

NEWS IN PERSPECTIVE

It is due April 15. In announcing the appointment of Aubrey J. Wagner as TVA director to replace Brooks Hays, Kennedy said that TVA "must prove in its second quarter century that it can remain vigorous as it grows old."

INDUSTRY SIFTINGS

PUBLIC POWER "PEACE OFFENSIVE" was renewed last month in Nebraska when directors of the Consumers Public Power Dist. proposed in a letter to directors of all public power agencies of the state (and to the Governor and members of the Nebraska legislature) a program designed "to seek equitable solutions of the conflicts which confront us (power agencies) and which obscure the great benefits to the citizens of the state." Charging that proposed legislation would force changes in the public power setup to the benefit of the "rurals" and without regard to the equities and rights of other districts and the ultimate users of electric service, the CPPD letter proposes getting together to work out new legislation that would cover defining service areas and functions.

"WE ARE LOSING CONSUMERS" and everywhere our service areas are being raided by other power distributors," Gen. Mgr. Clyde Ellis warned the annual convention of his NRECA last month. Another Ellis warning: "As our (power supply) requirements become more critical, we find ourselves more at the mercy of the investor-owned power companies. We must have a dynamic generation and transmission program."

FIRST FARM SALES PROMOTION organized by the nation's investor-owned electric utility companies begins April 1, with an advertising campaign in five farm magazines that will continue through 1961. Ad reprints will be distributed widely. Prepared by Compton Advertising (which handles the LBE national advertising program), the campaign stresses the theme: "Eight cents of electricity will do eight dollars worth of muscle work.")

BEST RESIDENTIAL WIRING PROMOTION was conducted in the past year by those investor-owned electric utility companies: Alabama Power Co., Pennsylvania P.&L. Co. and Dayton P.&L. Co., according to LOOK Magazine. Awards were made at the annual National Wiring Sales Conference last month. Electrical Leagues-Wiring Bureaus award went to The Electric Institute of Washington.

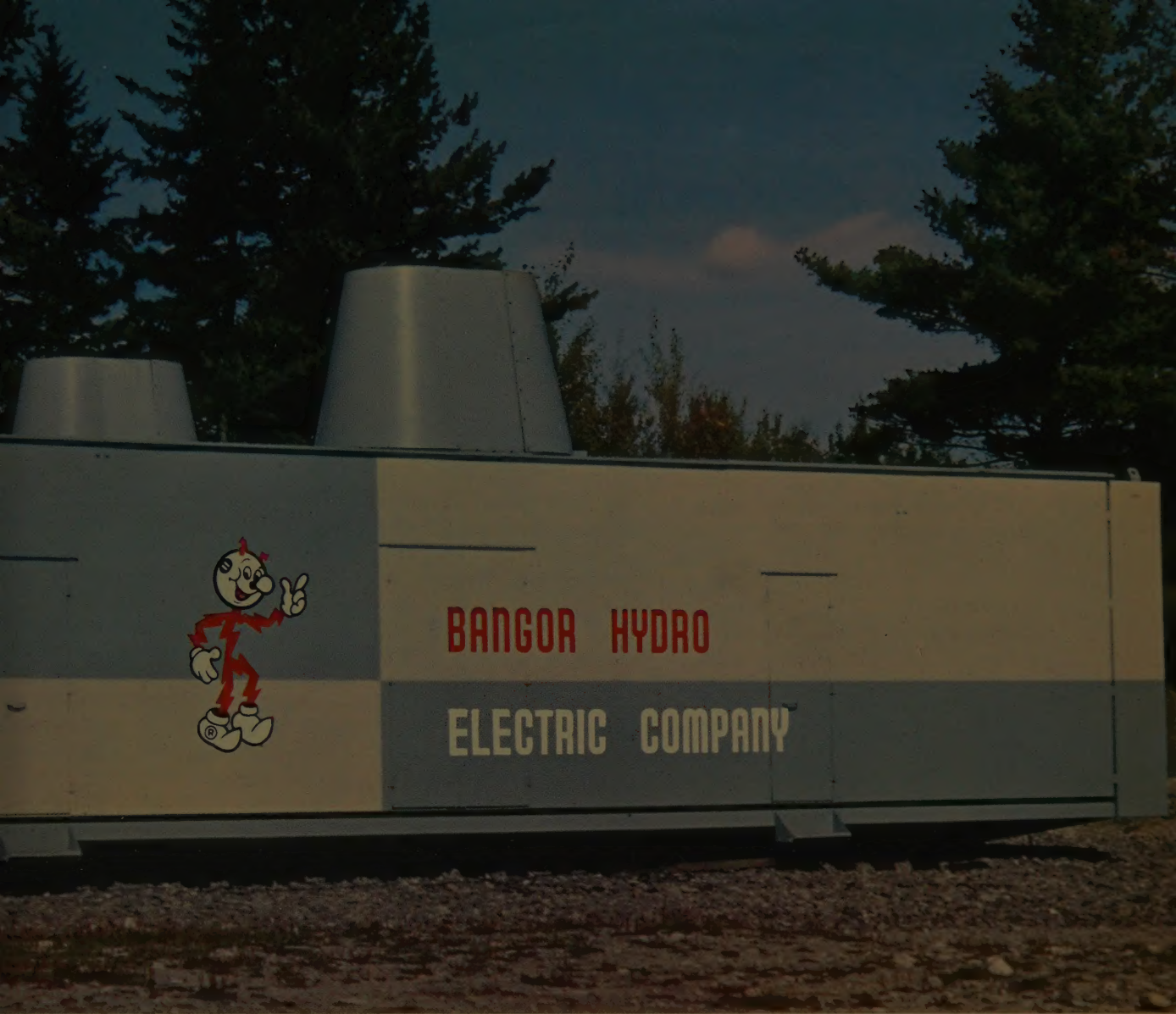
NEW POWER SOURCES--Progress is being reported from several laboratories, for example: In General Electric's general engineering laboratory in Schenectady, "the first working model yet announced" of a high-capacity "solid-state" electronic device for converting d-c to a-c has been tested successfully; the new products laboratories of Westinghouse in Pittsburgh designed and developed for Air Force testing a new lightweight nuclear generator for converting heat directly into electric power; and at the Everett, Mass. laboratory of Avco, a second-step generator has neared the 100-kw mark in generating power via magneto-hydrodynamics.

HIGH-BTU GAS FROM COAL will be needed in 10-20 years to supplement our supplies of natural gas, Martin A. Elliott, director of the Institute of Gas Technology told a meeting of the Society of Mining Engineers recently.

REVENUE FROM TRAFFIC SIGNALS may come to municipalities approving a newly patented device coordinating a lighted advertising sign with traffic lights--which turn red and green together! Inventor's claim: everyone watching for a light to change will read the sign.

FIRE SAFETY PROGRAM has been undertaken by a North Baltimore, Ohio electric co-op, which is promoting the sale through local distributors of "high-grade" fire extinguishers and battery-operated night alarm units for home installation.

HEAT-PUMP SERVICE PLAN including maintenance checks in fall and spring for five years after installation is a new out-of-warranty offer of the Kansas G.&E. Co. designed "to create more business . . . and to encourage more people to get into the heating business."



Motive Peaking Power for maximum savings

SECOND ELECTRO-MOTIVE DIESEL PLANT—

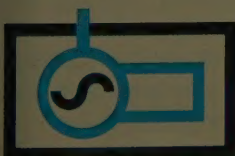
The success of the first Electro-Motive Plant at Medway led to the order of a second 8,000 KW plant to be installed in the southern area of the system. Due to be operating by the Fall of 1961, the new plant will also provide additional peaking capacity along with protection for another "end-of-the-line" area.

FLEXIBLE AND RELIABLE—The inherent design characteristics of the Electro-Motive Equipment at Bangor Hydro-Electric that make it ideal for peaking and area protection, also make these Plants ideal for many of your system requirements. With Electro-

Motive Equipment, you get fast start for spinning reserve, automatic dead load pick-up for area protection, remote control for peaking service, portability for simple installation, and freedom from damage to components caused by rapid thermal changes occurring from start to full load.

Electro-Motive Peaking Plants, available in sizes ranging from 2,000 KW to 10,000 KW, permit the most economical and efficient peaking operation, and provide for expansion at the lowest possible cost. Ask your Electro-Motive representative for complete details.

61-U-9



ELECTRO-MOTIVE DIVISION • GENERAL MOTORS

LA GRANGE, ILLINOIS

In Canada: General Motors Diesel Limited, London, Ontario



Tell Buyers: Teamwork Need Greater Than Ever

Even as the utilities are proceeding in investigations of grounds for recovering damages from suppliers held guilty of illegal marketing practices (see story opposite), responsible utility spokesmen repeat new messages re-emphasizing the vital need for continuing utility-manufacturer teamwork in holding the line of rising costs.

The changing role of R&D and the continuing need to lower capital equipment costs were considerations prominent in two such addresses delivered last month at the N A P A Public Utility Buyers meeting (reported also on page 70).



Earl Ewald

Northern States Power Co. Vice-President Earl Ewald assessed the first consideration at some length,

while John M. Warner, purchasing agent of the Philadelphia Elect. Co. discussed the second. Both stressed the reliance of power companies on the increase in equipment efficiency for offsetting other utility operating cost factors that are constantly rising in an inflationary economy.

Mr. Ewald recalled that, early in the history of the electrical industry the pattern was established wherein equipment manufacturers carried out the research and development work for the industry and built the tremendous research laboratories that we know today.

He added: "During 75 years of history, this industry team of utilities and equipment manufacturers has spent more on research and development than any other industry. The principal research effort has been made in the laboratories of equipment manufacturers but it has been sponsored and financed by the utilities. In recent years the

pattern is broadening with the advent of atomic energy, extra high-voltage transmission, and the exotic new power conversion methods so that the utilities themselves are spending more and more effort and money on direct research and development work. This change is necessary because the development work is being done before there is a commercial market for equipment.

"The combination of research and development, improvement of methods and growth have combined to make it possible for us, after 35 years in which prices have increased three times and wages have increased five times, to install a kilowatt for the same capital cost and produce kilowatt-hours at even lower operating costs.

"This carries over into other phases of the electric business," Mr. Ewald continued. "A typical transformer in 1930, such as a 37,500-kva unit, cost about \$2.20 per kva. Today we can buy a 385,000-kva unit for about \$2.20 per kva. A transmission line of 230,000-volts costs less than twice as much as one of 115,000 volts but it carries four times as much load so the unit cost is substantially less.

"The improvement of service reliability is an equally dramatic story of applied research," said Mr. Ewald.

"The utility industry, over the years, has strained every effort to reduce cost in the realization that low cost spurs greater use and makes possible the continued growth and expansion of the industry.

"In a cold objective analysis of the situation, it could be proven that our utility industry is actually a nonprofit operation. The history of the past 25 years will indicate that the industry has paid just enough earnings to its shareholders to maintain the necessary credit so that it could successfully go into the free market year after year and obtain the huge amounts of addi-

(Continued on page 44)

Utilities Study "Damages,"

Move Vs. Suppliers For Investors, Users

The interests of stockholders and customers have been uppermost—and properly so—in the approach of utility company management to the possibility of recovering "damages" which may have been sustained in purchasing billions of dollars worth of equipment from electrical manufacturers who last month were convicted under the government's anti-trust actions. A survey of utility companies by EL&P indicates that most, if not all, are making thorough studies before considering any specific action.

Within a week after the 29 companies were assessed nearly \$2-million in fines (and 44 corporate executives received individual fines, and in some cases jail sentences), resultant development in the situation looked like this:

1. The industry—in the view of the abruptly (and partly) informed public—had a black eye. And, that covered utility customers along with the legally offending manufacturers who supply them.

2. Action to recover damages, under provisions of the law, could come from many organizations which bought equipment in the period involved in the alleged collusive and price-fixing practices. Most energetic about plans for such legal moves were public power groups, but investor-owned companies also revealed similar steps to recover damages, when and if the record could be established.

3. Manufacturers moved quickly to salvage the corporate image, with short-term concern for the offended public, but longer-term interest in preserving valued relations with the utility customers who are now arrayed against them in legal maneuvers in which perhaps only the lawyers will win.

Only certain aspect of actions

en in the days immediately after sentencing and fining decisions Philadelphia on Feb. 6 and 7 was the likelihood that ultimate legal moves would be weeks and probably months away. (Suits to recover damages can be instituted within about a year from the date of conviction.) The difficulties of establishing instances and amounts of damage incurred seemed substantial . . . and it also could be considered possible that actual damages might not reach the huge amounts referred to in the comments of some who might have motivation other than the restoration of sums of money to the "damaged" customer organizations. One manufacturer revealed the results of a study in which its own equipment prices for the period in question were compared with prices and lines of other commodities, and the conclusion was reached that "they do not vary materially from the comparable indices.") Beginning with the federal government itself, these were the prospects of legal efforts to recover damages from the convicted manufacturers:

1. The Justice Dept., according to an announcement by Atty. Gen. Robert F. Kennedy, shortly after their sentences were pronounced would file damage suits "within 60 months" in behalf of federal agencies, at least 20 of which purchased equipment from the accused suppliers.

2. State, county and municipal officials pressed investigations in behalf of agencies which may have paid more for equipment through the bidding practices charged by the Justice Dept. The National Institute of Municipal Law Officers indicated that some 170 cities across the nation are named in lists attached to the complaints filed by the federal anti-trust prosecutors.

3. Investor-owned companies throughout the country stepped up studies (in many cases started as long as a year ago) in anticipation of the convictions and subsequent court action, to ascertain damages sustained as basis for legal recovery.

The task for all was a formidable one. Contracts dating back as much as ten years had to be inventoried, and of course, the means of showing what extra amounts were actu-

ally paid for equipment over this period has to be developed too.

The public bodies, generally, seemed more certain of the possibilities of proving offenses suffered.

Meanwhile, it was certain, too, that the outcome and the actions and philosophy that led to the charges would be argued and discussed in business circles and elsewhere for years. No more significant exchange of such observations would ever take place, probably, than that coinciding precisely with the dates of the Philadelphia rulings—in Detroit last month at the annual meeting of the NAPA Public Utility Buyers Group. At this conference, of course, utility buyers and suppliers have met for years. (A report on this year's conference appears on page 70.)

Explanations for the circumstances creating the situation—"Feast-and-famine" buying, price shopping without much regard for other values, etc.—have frequently drawn into the blame the utility purchaser. But, this was one factor which would not figure in the record of damages incurred.

Speaking for the Edison Electric Institute, Pres. Sherman R. Knapp, emphasized that the problem of determining possible legal actions against the manufacturers is one for each individual company. However, the EEI spokesman issued this statement on Feb. 9:

"All of the electric companies are

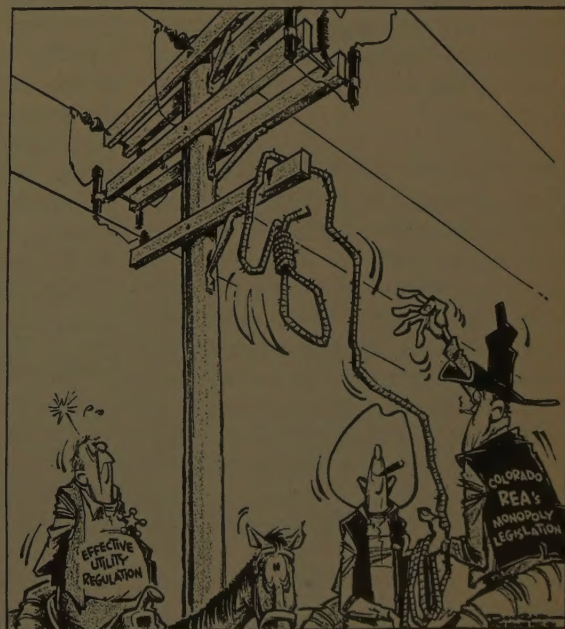
very much concerned about the situation regarding the anti-trust suits against the electrical manufacturers. I am sure they are studying the matter very carefully to determine the extent to which they have been damaged. But, because the problem is one applicable to individual companies in their own particular situations, the Edison Electric Institute is not involved."

Mr. Knapp revealed that his own company, the Connecticut L. & P. Co. was "making a thorough study" of purchases from the convicted manufacturers to find out the extent of damages. And, utility by utility, this was the status over the nation, with all of them pointing out the fact that some time would be needed to determine what legal actions might follow. Among these were: ConEdison, Middle South Utilities, Portland G. E. Co., Puget Sound Light & Power Co. and Arizona P. S. Co. Some companies planned to include statements on the problem in their 1960 annual reports—among them, General Public Utilities and West Penn Electric.

Somewhat alone in its position, the Otter Tail Power Co. reports that it contemplates no action involving the equipment manufacturers. The utility's executive vice-president, Albert V. Hartl, was prepared in mid-February to state: "Otter Tail Power Co. feels that it has received full value from any payments made."

THE LAW WEST OF DODGE

The "Denver POST" reproduced this cartoon (by Conrad) recently, along with an editorial entitled: "The REAs Expect Too Much." In part it notes that Colorado's REA Association has turned to the legislature for a "remedy" that appears extreme. —It would prohibit duplication of electric distribution lines into areas now serviced by REA. ("Duplication" would come from lines of Colorado P. S. Co.) The editorial concludes: "To guarantee the REAs a share of metropolitan markets, when their charter intended them to serve rural areas, is expecting too much."



Commonwealth Edison's Chairman Willis Gale expressed the view of almost all of the top executives: "One thing is certain—we are determined to do whatever is necessary to protect the interests of our customers and our stockholders."

In most other utilities, the management view, apparently, was that if investigations were not thorough and subsequent suits were not brought where justified, legal action might possibly be taken against the utilities by stockholders.

Here is EL&P's roundup of utility positions on the matter of proceeding to recover damages, if any, sustained in purchasing equipment from the manufacturers found guilty of illegal practices under the anti-trust laws:

COMMONWEALTH EDISON CO.—"The company has been looking into the matter since the first government indictments were announced about a year ago. Edison's two regular law firms and our own accountants have been checking since that time, and last June special counsel was retained. The collection of all the pertinent facts has been a complex task; and, therefore, it will be some time before we can make a sound appraisal of the damages we have suffered. We have approximately one year within which to institute legal proceedings if that course of action proves necessary."

DETROIT EDISON—"The company is making a complete and detailed study of all relevant purchases made from the equipment people during the period concerned. We have no basis for further comment at this time."

NEW ORLEANS PUBLIC SERVICE CO.—"Our company is actively studying records of past purchases during periods covered by indictment to determine extent of such purchases from manufacturers involved. Legal counsel for the company is analyzing our rights in the matter. When studies have been completed, a decision will be made as to what action the company might take."

INDIANAPOLIS POWER & LIGHT CO.—"We are investigating the matter, which is a large undertaking, and have reached no conclusions as to what action may be taken."

OKLAHOMA GAS AND ELECTRIC CO.—"Officers and Board of Directors have discussed contemplated action but no decision has been made to date."

UNION ELECTRIC CO.—"We are looking into the situation. It is a very complex subject and until our investigation is complete we have no statement to make."

WISCONSIN ELECTRIC POWER CO.—"We have no basis for reaching any conclusions on the matter at this time. The matter (triple damages suits) is in the hands of our counsel. I don't know now what our future course will be. We'll be guided by our counsel. They are studying it, and it will take some time."

CALIFORNIA UTILITIES—So. Cal. Edison, Pacific G. & E. Co., San Diego G. & E. Co., and Cal. Elect. Pwr. Co. have retained a Los Angeles law firm to help them determine whether they have been overcharged and whether or not they should sue if overcharges are found.

CONNECTICUT L. & P. CO.—"The management of CL&P is watching with a great deal of interest the results of the recent anti-trust suit. A lengthy review of its purchases of the equipment involved has been undertaken to determine whether it suffered any damages. How the damages, if any, can be recovered is under study by the company's legal advisors."

LONG ISLAND LIGHTING CO.—"Lilco has been alive to the situation for months and will take any steps which may be indicated to protect the interests of its stockholders and consumers. As has appeared in the public press, the major manufacturers appear to be desirous of settling these problems on some fair basis. At this point we cannot predict the outcome of these endeavors."

Teamwork—Cont. from p. 42

tional capital required to support expansion. In other words, it has hired capital at the going rate of the market in the same manner as it has hired labor and purchased equipment. Behind these reasonable, necessary wages for the capital employed, there has been no profit and all the benefits stemming

from improvements and growth have been passed on to the users.

"Every man among us—whether we are buyers or turbine operators—must sell the dynamic, progressive, successful image of the industry; the increased use of service; and the importance of retaining the industry in business-managed control on the basis that this system is in the best interests of the consumers for their own selfish well-being," concluded Mr. Ewald.

Mr. Warner declared that lower capital equipment costs are certainly the key to future growth of the electric power industry . . . so that "it behooves utility and manufacturer to find new ways of lowering these costs."

How can this be done effectively?

"We in the utility industry should plan new ways to avail ourselves of the larger capacity equipment with its lower cost per kilowatt (as, for example, by such methods as common generating stations for a group of neighboring utilities); perhaps there is still a further way to go in utility acceptance of standardized designs or acceptance of less incremental steps in the capacities of various electrical equipment, thus allowing for more repetitive manufacture with accompanying lower cost, without sacrificing quality of design and performance, because reliability of service is of continuing importance to our future growth.

"Are we as utility buyers doing all we can in our companies to assist in the acceptance of these ideas which can lead to lower capital costs? And are the manufacturers, in turn, realistically pricing the standardized, multiple-manufactured items so as to reflect the true price differential between such items and the so-called special, non-standard items that a particular utility may request?

"Such common aims on the part of both utility and manufacturer could result in lower capital costs to the benefit of both. For each \$1.00 of lower capital cost will result in \$3.86 to the customer in the form of lower rates. Thus the customer may use this "compounded" money for greater use of our product and accelerate the growth of the utility and manufacturing industry in the decade ahead.

ORGANIC POWER REACTOR PROJECT, on which the AEC invited expressions of interest last December, could be set up in Vermont, Texas, Ohio, Maryland, Wisconsin, Mississippi, Oklahoma, Nevada or New Mexico, if the Commission proceeds from evaluation of initial "expressions" to the next step—invitation to any of the operatively- and publicly-owned utility organizations in those states to submit formal proposals. The AEC is making a preliminary determination of acceptability, from a safeguards standpoint, of reactor sites proposed, with the intention of issuing invitations to submit such proposals if it appears likely that a responsive formal proposal can be expected. (As a first phase of the program for developing the prototype plant (10,000-kw), Atomics International is conducting conceptual design work for the AEC.)

TE CRITERIA GUIDES—prepared in preliminary form to make industry, state and local officials and the general public familiar with factors considered by the Commission in judging proposed sites for reactors—are out for public comment prior to issuance in final form. Suggestions must be sent to the AEC Div. of Licensing and Regulation by the first week in May. (Meanwhile, while the debate over locating nuclear power plants "only in the desert" versus at or near load centers grows stronger, one inevitable development has become evident: where such projects are constructed in reasonably accessible locations, people and economic activity will be attracted in short order—so that "radioactivity" from population center is not likely to be a condition maintained for long.)

RESIDEN CORE LOADING deliveries will begin this month, the first of two complete loadings valued at \$10-million. Meanwhile, later this month (on the 27th) PRDC's case for an operating license will be aired in oral arguments before the Supreme Court.

ANKEE PLANT TEST RUN of 500 hours at 110,000-kw, completed in mid-February, checked out the entire plant in a "satisfactory operation," according to Pres. Jim Webster. After an AEC ok, the plant is scheduled for operation at the designed capacity of 136,000-kw.

AS-COOLED REACTOR FACILITY construction at the National Reactor Testing Station will start this summer, proceeding in phase with research and development work underway at General Atomic facilities in San Diego. The experiment is designed to provide data for maritime and other civilian power applications.

EC SYMPOSIUM ON URANIUM CARBIDES will be held on April 4 at Commission headquarters in Germantown, Md., with no advance registration required for the no-fee briefing. Purpose: to acquaint industry representatives with AEC research to develop uranium monocarbide and uranium dicarbide as fuel materials for nuclear reactors. (Laboratory quantities of uranium monocarbide in the form of granules or high-density spheres are now available from Vitro Corp. of Amer-

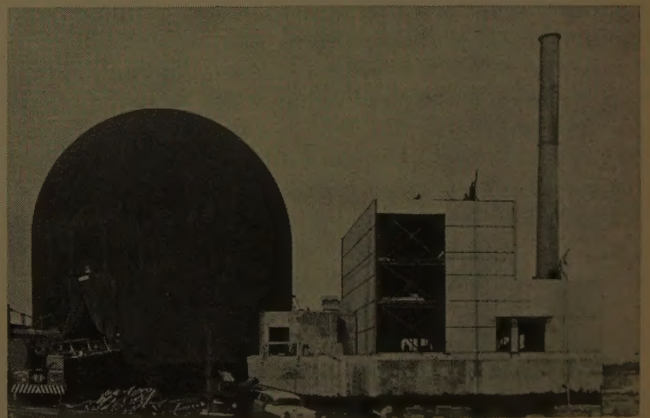
ica, which notes that UC "combines high thermal conductivity, melting point and uranium density with an excellent irradiation stability.")

FIRST PEBBLE-BED DESIGN utilized in a reactor beyond the research stage is incorporated in a project under construction in Germany, Mallinckrodt Nuclear Div. is supplying 325.6-lbs of 20-percent enriched uranium for the 15-megawatt high temp. gas-cooled reactor.

SEPARATE SUPERHEAT REACTOR to be located at GE's Vallecitos Atomic Laboratory—the world's first—will be housed in an 80-ton pressure vessel to be constructed by the Nooter Corp. of St. Louis. Seven N. Y. State power companies are contributing \$5.7-million towards the \$8-million cost of the project, which will utilize the superheat to raise the temperature of steam produced in the VBWR to levels achieved in conventional steam-generating plants using modern turbine-generator equipment.

"**ABOUT AT BREAKING POINT**" is the way the status of suppliers to the nuclear power industry is described by PRDC's Gen. Mgr. Robt. W. Hartwell. In terms of available business and profit-and-loss, the suppliers are in an unhealthy condition, they have sustained substantial losses . . . and there is now an unhealthy attitude of unrest," he notes. "In view of this, we can expect to get some very competitive bids, but before orders are filled, some of these suppliers are likely to come in and tell management, 'we are losing money'. It doesn't do us (in the utility business) any good to see such suppliers go out of business," he warned.

U₃O₈ PURCHASE PROGRAM, arranged since the first of the year with South Africa, covers the supply of the uranium concentrate at a fixed price averaging about \$11.20 per pound, f.o.b. vessel, Durban So. Africa. Eleven deliveries to the U. S. are to be completed by the end of 1966; while the U. K. has arranged for a stretchout of deliveries extending through 1970.



First atomic power plant to be operated by a municipal utility will be this 11,400-kw station under construction at Piqua, Ohio. Part of the AEC's power demonstration program, the Atomics International-built plant is to be finished this summer.

Kansas Court Rules:

Commission Must Make Findings of Fair Value, Both for Rate Base and Depreciation Expense

This is unquestionably one of the outstanding rulings in the field of public utility regulation since the end of World War II. The case involved the Southwestern Bell Telephone Company of Kansas which petitioned the State Corporation Commission of Kansas for a rate increase in the amount of \$5,800,000. The Company's plea was based on the need to give recognition to a fair value rate base and to economic depreciation which are both required under a prior Kansas Supreme Court ruling. The Commission denied the Company's proposed rate increase, and granted only \$1,321,427. The Company thereupon took its case to the District Court of Shawnee County. On January 4th the Court reversed the Commission on most of its major points. After the Court denied a motion for a retrial, the Commission announced that an appeal would be made to the State Supreme Court.

Findings of a Fair Value Rate Base

The Court pointed out that under Kansas statutes the Commission is required to make a determination of fair return on the value of *property* devoted to public service. It is not permitted to use the end result method promulgated by the U. S. Supreme Court in the Hope case. In this instance, as long as rates are just and reasonable, the court "then reviews only the end result to determine if due process has thereby been violated."

The Court made an important contribution to realism in regulation when it noted in part that:

"In instances wherein the legislature has granted maximum authority to a commission (i.e., the legal right to make an end result finding), almost invariably, the commission will select the investment theory. This is for two reasons. First, for the stated reasons, that it is more accurate, more reliable, less subject to judgment decisions, and, secondarily, for the reason which is seldom discussed, that currently, use of this method will achieve the lowest legally possible returns to the utility, *and the commissions presume that such is in the public interest.*"*

The presumption of course is far from correct. A number of studies have shown that those utilities that have good earnings have rates lower than those companies whose earnings are poor.

In reaffirming the rights of States versus the Hope decision, the Court noted that:

"Inasmuch as both the U. S. Constitution and the Kansas statutes required the use of fair value in 1924, it is appropriate to consider whether the Hope case, which changed the constitutional requirement,

also had the effect of changing the Kansas statute. I think it is clear that a decision of the U. S. Supreme Court changing the interpretation of the U. S. Constitution cannot have any effect upon the Kansas Court's construction of a state statute."

The Opinion noted further that:

"Admittedly this illustration tends to over-simplify the rate making process, but it illustrates the fact that inflation has made pre-war original cost figures almost meaningless as evidence of value today. It should be further noted that the Kansas due process clause protects the value of the owner's property; it does not merely protect the number of dollars invested in that property. This is obviously true in condemnation cases and it would seem to be equally true with respect to the property of a utility which runs the risk of having its property confiscated in the regulatory process."

The Kansas Court noted the Iowa Supreme Court reference to the Hope case and the end result doctrine in the following terms:

"Not endowed with psychic powers the writer of the majority opinion in the Hope case could not have been expected to, nor had he occasion to, predict the erosion of the value of the dollar which was to come in the later period."

Importantly enough, the Court considered that:

"One further comment on the use of value as a rate base seems in order. If the United States had experienced inflation of several thousand per cent, such as has been experienced in France, Italy and several South American countries, the 1940 dollar would now be worth a fraction of a cent instead of about 50 cents. If such inflation had occurred, no one would be bold enough to suggest that original cost could be used as a rate base. If property which cost \$100 in 1940 was now worth \$3,000 or \$10,000, intelligent regulation would be impossible without considering that fact.

"Fortunately inflation in the United States has been only about 100% instead of several thousand per cent. But the economic principle is the same, and the effect of that 100% inflation on the property of the utility must be recognized. In the field of utility regulation, legal and constitutional principles must conform with sound economic principles."

The Court should have noted that what happened abroad with regard to inflation could also happen here. The only difference up to now has been the rate at which the dollar has lost its purchasing power. The "end result" may be the same as far as the utility industry is concerned.

It is important to note that the Court sustained the Company on the inclusion of going concern value

* Italics supplied

the determination of the fair value rate base. The opinion noted in part:

"The Commission rejected these additional factors affecting value on the ground that they were based on judgment. It rejected going concern value on the ground that such value results from the monopoly granted to the Company, although Witness Patterson specifically stated that the value of the Company's franchises was not included in his allowance for going concern value. He testified that going concern value, as he used the term, included the costs incurred in establishing the enterprise as a fully developed, operating business.

"Going concern value is an element of value which should be considered in establishing the reasonable value of a utility's property for rate making purposes. This was recognized by the Kansas Supreme Court in the 1924 case. Its determination necessarily involves the exercise of informed judgment. Because of the difficulties involved in determining going concern value and the degree to which judgment is involved, the Commission's judgment on this point should not be lightly overturned. I do not consider that it is the function of the Referee to determine whether the allowance made by Witness Patterson is reasonable. On the other hand, I conclude, on the basis of the 1924 case, that the Commission should give some weight to this element of value."

Depreciation Expense

The Company in its rate case proceeding had contended that depreciation must be based on the current cost of property. This the Commission rejected on the ground that it was not consistent with the original cost doctrine under which the Commission had set rates, and that the only dollars which the Company was entitled to recover were those originally invested in the property. This of course took no account of the fact that inflation had materially changed the purchasing power of these dollars. The Opinion noted:

"Obviously this issue, like others involved in this case, is a simple issue created by inflation. Should depreciation expense recover only the number of dollars invested, or should it recover the value of the dollars invested, i.e., the value of the property being consumed? If the cost of the Company's facilities as recorded on its books in historic dollars were the same as the current cost of those facilities, this issue would not be before me. However, the disparity between accounting dollars and real dollar values, shown by the record, makes the issue a significant one in the establishment of utility rates."

Rate of Return

The Court upheld the Company in its contention that the Commission did not properly apply the comparable earnings standards in arriving at the allowable rate of return. The Opinion noted that there must be three constitutional standards:

"(1) The return must be sufficient to enable the utility to attract new capital on reasonable terms—the 'cost of capital' test;

"(2) The return must be equal to that generally being made at the same time and in the same general part of the country on other investments which have similar risks and uncertainties; and

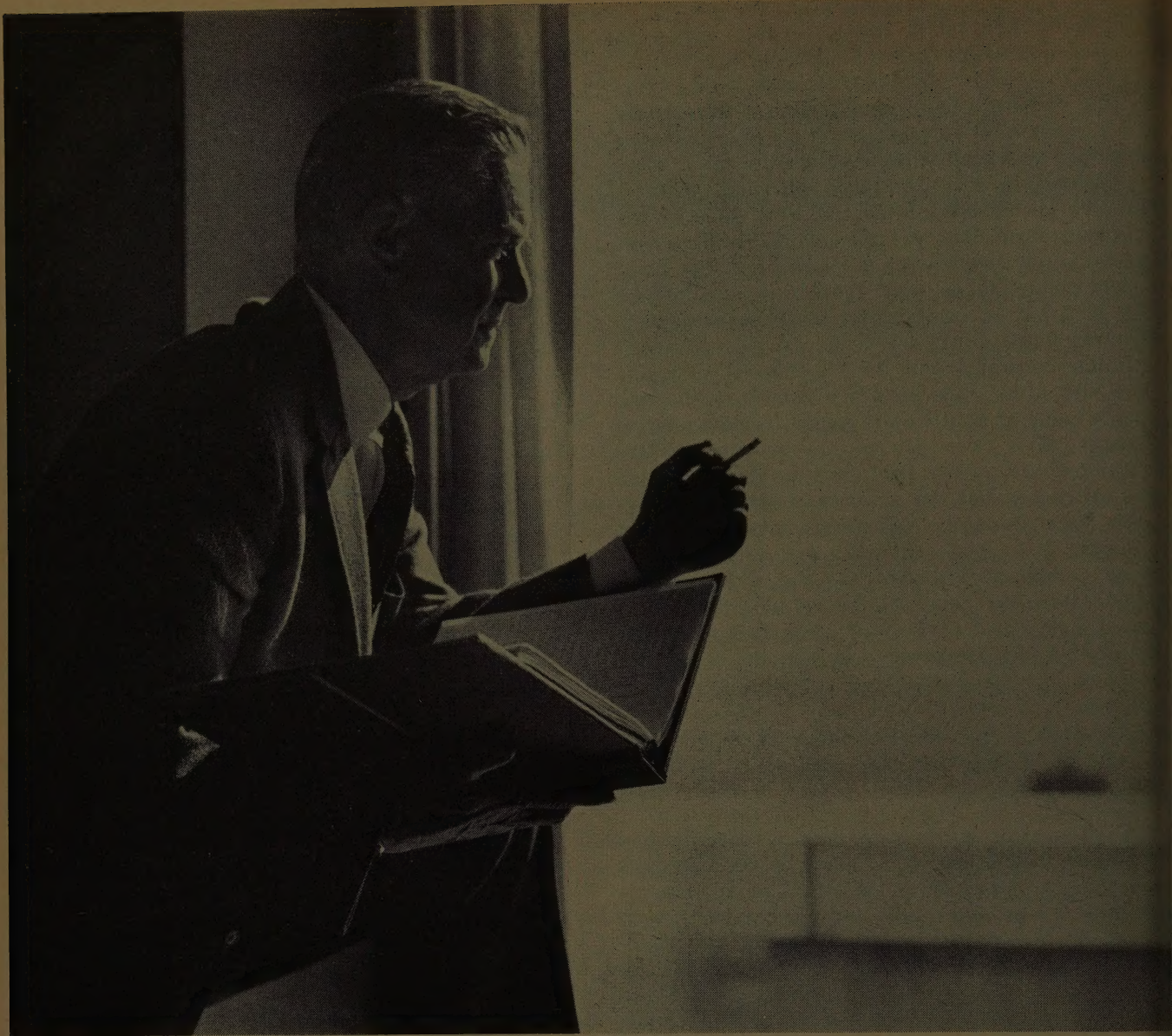
"(3) The return must be sufficient to protect the financial integrity of the utility."

"The Order plainly shows that the Commission rejected all of the Company's evidence on the comparable earnings test. The Order purports to show that comparisons were made with the earnings of A. T. & T. and five other Bell System companies, and that these are the only 'comparable' companies with which comparisons can be made. Such comparisons are largely meaningless. Since the Company is a subsidiary of A. T. & T., it does most of its financing through A. T. & T. Meaningful results are not obtained by comparing one with one's self. Further, such an approach would simply mean that whatever condition regulation had imposed on the telephone companies—regardless of whether the condition was one of low earnings or high earnings—is the right condition and should be perpetuated. This is not consistent with the principle that regulation is a substitute for competition and should strive to create conditions similar to those under which unregulated businesses operate.

"Even though there may be difficulties in comparing the Company's earnings with those of non-regulated business, I must conclude that this is what the law requires. This is in fact the type of comparisons which were used in both the *Bluefield* and the *Hope* cases. Comparisons with other regulated businesses can be considered, but to use them exclusively would be in effect saying that whatever the regulatory body did to one utility was right for the next utility. This is neither logical nor lawful.

"From the investor's viewpoint, he has the choice of investing his capital with the telephone company or with any other business, regulated or non-regulated. Regulation, per se, does not make the utility investment more attractive; on the contrary, harsh regulation will make the investment far less attractive. Since the investor compares all types of possible investments before committing his capital, it is proper to compare earnings of the Company with the earnings of non-regulated businesses which present similar investment opportunities to the investor. The error which seems to underlie the Commission's mis-application of the complete earnings standard is that it seeks to find an identical company for comparison rather than businesses which afford similar, and therefore comparable, investment opportunities. Two businesses may be quite different in many respects and still constitute similar investment risks insofar as the investor is concerned."

There is no question but that the comparable earnings standards will assume increasing importance in arriving at a proper rate of return for a regulated public utility. Furthermore, outside of the Bell System, insufficient attention has been given to this method by the electric utility industry.



How long will utilities be able to buy the right kind of coal?

In the look-ahead world of electric utilities, 1981 can be here tomorrow morning.

The projected growth rate of electric needs makes it clear that the man who buys coal for a utility must pick his suppliers not only for what they can deliver now but for the next 20 or 30 years. He must be able to count on adequate reserves—of not just *coal*, but the right *kind* of coal. Coal that's free of hidden incremental costs that raise the invoice price with excessive coal handling, ash handling, equipment outages and freight charges on inerts. Coal that can deliver steam at the lowest possible cost.

To this utility man who lives partly in 1981, Island Creek offers a mighty reassuring picture of long-term quality and uniformity of supply. We'd welcome a discussion of your own searching look into that *very* near future. Write, wire or phone.



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Ominous Pattern Clouds Utility Horizons

The strong public power leanings President Kennedy's appointees to key federal jobs, spell headaches ahead for electric utilities.

In discussing the election impact, a page in the January 1 issue pointed out that "No mature appraisal of how radically the new administration may attempt to re-emp federal power policy, or expand federal power activities, can be made at this writing. A picture with some meaning will begin to take shape, however, as Kennedy names the men to fill various power-strategic posts . . ."

With most of these posts now filled, the picture has become clearer. It is not a very pretty one. A well-rounded description of it was put on record by Senator Barry Goldwater (R-Ariz.) during the debate on confirmation of one of the appointees:

"I rise . . . to call the attention of the Senate to the pattern which this administration seems to be following in the appointment of men who will occupy positions of control and influence in the power field . . . These positions are being filled by persons who not only have shown a strong bias in favor of government power, but some are doctrinaire public power advocates—in effect crusaders for government power."

Disclaiming any intention "to champion the interest of the electric power companies," Goldwater declared: "My own interest in them is their position as a segment of our free enterprise system that has never failed us in time of emergency and which stands ready to provide our future needs. . . . During these trying times when our federal, state and local budgets are stretched to their very limit to meet our needs for defense, education, roads, streets and the like, why should we spend tax money on things that our citizens can and will do through the free enterprise system?"

The Senator continued with a

line-up of the Kennedy public power team:

Interior Secretary Stewart Udall—"If we go by his voting record during his service in the House of Representatives, the electric companies can take no comfort in his appointment."

Interior Under Secretary James Carr—" . . . his background in the electric power field is that of government power. He has been assistant general manager of the Sacramento, Calif., Municipal Utility District, which is a form of government ownership and operation."

Kenneth Holum, Assistant Secretary for Water and Power—" . . . has a longtime record as an advocate of government ownership of electric power. He has been active in several rural electric cooperative organizations which have advocated more and more federal power . . . More recently he has been chairman of the Mid-West Electric Consumers Association, which has strongly advocated a giant (publicly owned, hydro and steam) electric power system in the upper Missouri River Basin States . . . His background in the electric industry has been that of a crusader for public power."

John A. Baker, Director of Agricultural Credit Services, which largely controls REA lending policies. He comes from the National Farmers Union, where he held a high office—"The National Farmers Union has been crusading not only for public power, but also for every other type of leftwing philosophy there has been in this country for the past many years."

Joseph Swidler, named to be Chairman of FPC, and formerly a TVA lawyer for 24 years, the last 12 of which he served as general counsel—"Any of us who followed his career in that position will know that he was in favor of all-out federal development of electric power, both steam and hydro-electric, in the TVA area. I doubt that one could find a more ardent supporter of federal power in this

country than Mr. Swidler. After he got out of TVA in 1958, he entered private law practice. I understand he has been very active in the Citizens for TVA group, which spends its time dangling the bait of cheap federally subsidized electric power as an incentive for enticing industries from other areas to the Tennessee Valley . . . The new administration has designated as the new Chairman of the FPC—a supposedly quasi-judicial body of the government, an agency set up to regulate the electric utility industry—a man whose entire background is that of an advocate of government power."

Howard Morgan, named to FPC, and former Public Utility Commissioner of Oregon—"I am told that during his term of office (as Oregon PUC) he showed very distinct prejudice against segments of the industries under his jurisdiction, in particular the railroads and the electric companies. One of the Oregon newspapers which was not averse to his appointment said that he could be a good commissioner if he could rid himself of some of his built-in opinions and prejudices."

The picture was further completed by the subsequent naming of **Norman Clapp**, a Wisconsin newspaper publisher, to be REA Administrator. He is the brother of Gordon Clapp, former Chairman of TVA and an ardent advocate of government power. The new REA head was strongly supported for the job by high-up national labor union officials.

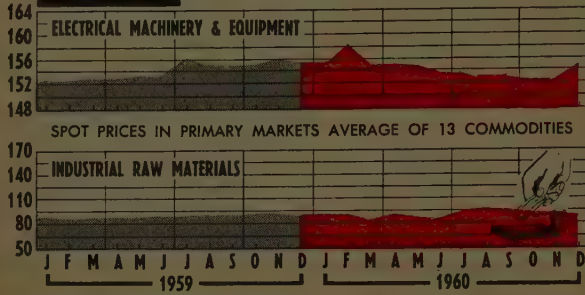
It is possible, of course, that the picture as a whole may not turn out to be as gloomy as some of its component parts would indicate. As Goldwater put it: "I feel and hope that these men will be able to dissociate themselves from their background and will render unbiased decisions when those decisions confront them."

But such a hope appears to be a slim one, indeed, in light of the significantly selective pattern of the Kennedy appointments. Only time will tell.

MARKETING GUIDEPOSTS

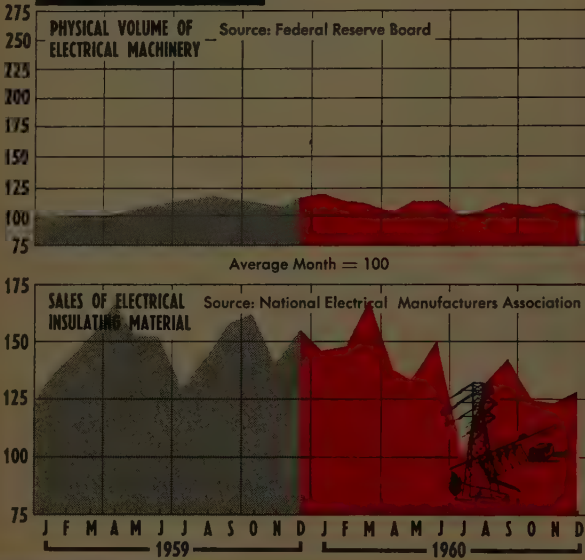
INDEX OF PRICES

Source: U. S. Dept. of Labor: (1947-1949 = 100)



ELECTRICAL MANUFACTURING

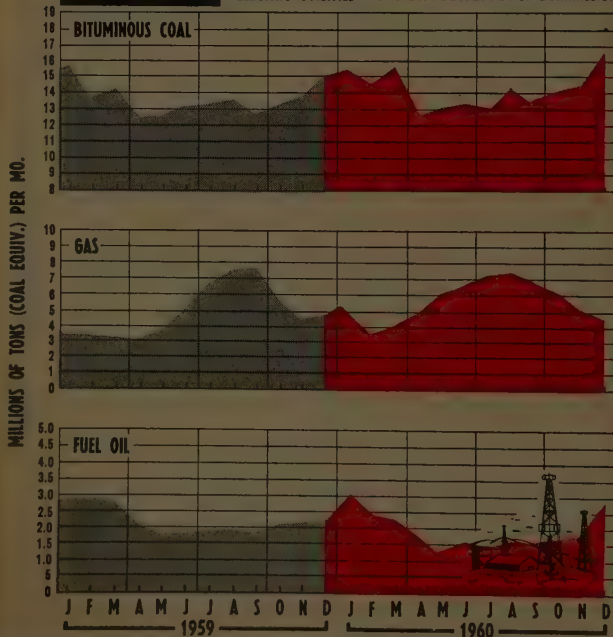
Based on 1957



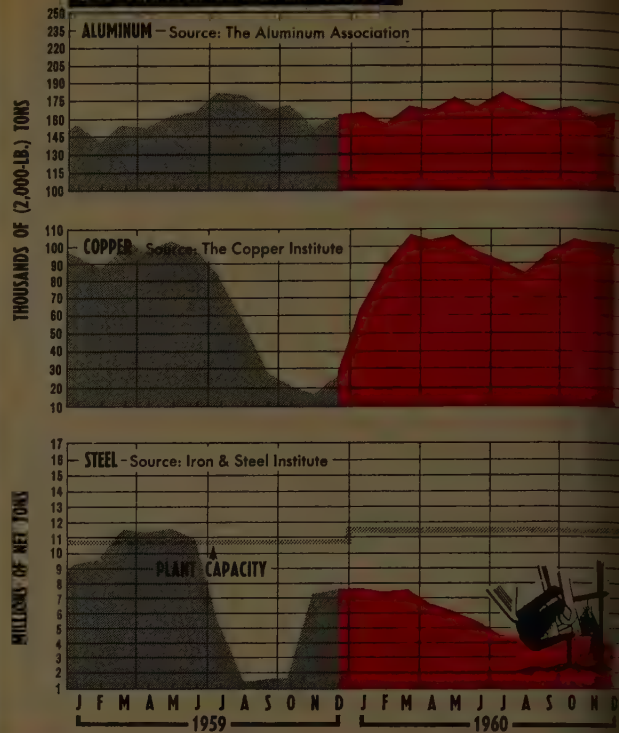
FUEL CONSUMPTION

ELECTRIC UTILITIES

Source: Federal Power Commission

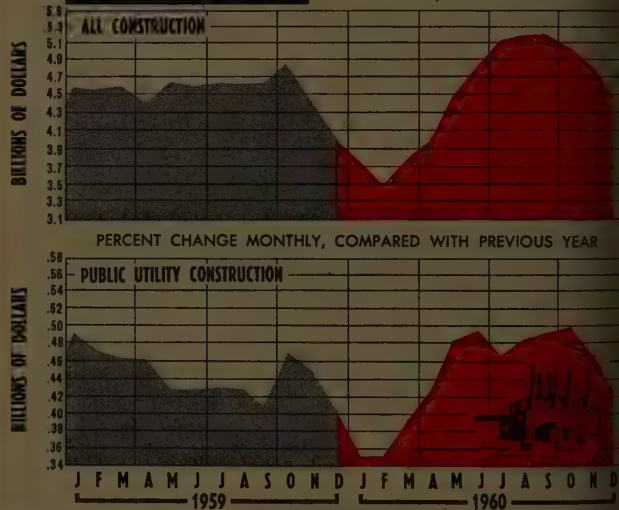


U. S. PRODUCTION OF PRIMARY METALS



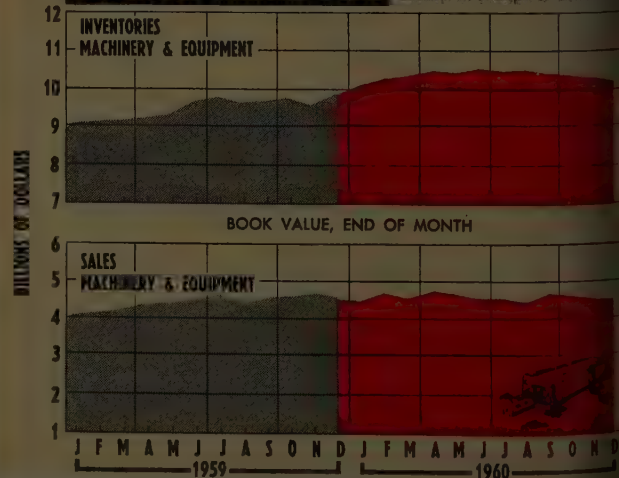
NEW CONSTRUCTION ACTIVITY

Source: U. S. Dept. of Commerce



MANUFACTURERS' INVENTORIES & SALES

Source: U. S. Dept. of Commerce



SP RETURNS

O ENVELOPE BILLING

Customers of Northern States Power now receive their bills in envelopes, enabling the Company to enclose stuffers to promote sales and better public relations; also to present facts about Company and the electric industry.

R. D. FURBER, Director
Information and Advertising, Northern States Power Company

AFTER TEN YEARS of billing customers throughout its four-state service area by postcard, Northern States Power Company last year began mailing customers' bills in envelopes. The switch-over to envelope billing was made over a seven-month period, as customer billing operations in NSP's 18 divisions were converted to the Company's computer. By January 31, 1961, virtually all of Northern States Power Company's customer billing will be done by the electronic computer, and by the same date, all customers will be receiving their bills in envelopes.

NSP had two primary reasons for turning to envelope billing, and both were involved with customer relations. First, there were indications that more and more customers had come to view their bills as a personal matter and as such, should be handled more confidentially.

Secondly, the Company felt a growing necessity to reach customers with more public relations information, in particular, as well as more sales promotion advertising. There was no better way to do this directly than by enclosing inserts with bills going to more than 700,000 NSP customers. The need for more public relations material arises from the fact that NSP, like other utilities, expects customer use of electricity to double in the next ten years and consumption of natural gas supplied by the Company to increase substantially in the same period.

While most NSP customers have been cognizant of the fact that their use of gas and electricity has increased greatly in the last two decades (as much as four-fold), the

Company felt that in the future customers might well be more aware of higher utility bills than of their increasing use of electricity and gas. The result would be more high-bill complaints. Therefore, NSP felt it imperative to increase its advertising through the medium of envelope billing so that customers will better understand and appreciate what they are getting for their money.

Letters Explained Why

NSP's stuffer program was inaugurated in July, 1960, by enclosing in the first envelopes letters to customers explaining why the Company was initiating envelope billing. The letter stated:

"As you have noted, your bill was enclosed in an envelope this month. This policy will be followed in the future because we believe our customers feel a bill is a personal matter and should be so treated."

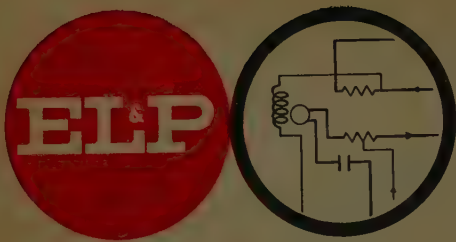
About three-fourths of the customers from whom the Company heard after the first envelope billings approved of the new system. Others were concerned that the increased cost of envelope billing would eventually bring an increase in their rates. A second letter, part of which is quoted below, assured them that this would not be the case:

"A large majority have indicated that they do consider their electric bill a personal matter and prefer the new policy. However, a considerable number have questioned whether the additional cost is justified and whether this will result in increased cost of service. Please be assured that this will have no effect on our rates. True, there will be a modest increase in cost — principally the one cent increase in postage — but there are offsetting savings. The envelopes will provide a means of communicating with our customers not available with postcards. In particular we plan to furnish information from time to time concerning new developments in our

(Continued on page 80)

Northern States Power Company's computer center, where customer billing operations are handled for all of the Company's 18 divisions.





ENGINEERING-OPERATIONS

Computer Control At Gulf States

Gulf States Utilities will install the first computer control system in an existing electric generating plant in Riverside Station at Lake Charles, La.

Commenting on how the installation will achieve economics in generating costs, John A. Reich, system production manager said, "Riverside Station will be used to provide power to meet electrical loads that occur when power requirements are greatest. When the power demand is down, the computer will automatically shut down the turbo-generators and start them up when the next peak period occurs. In addition, the new control system will make possible safer and faster start-up of the station, including boilers and steam turbines."

Progress At Niagara Power Project



World's largest gantry crane eases 590-ton generator rotor into its pit-mounted stator at Robert Moses Niagara Power Plant. The Milwaukee Crane 630-ton gantry successfully lowers the rotor with only 5/8 in. all around to the stator. The crane had to position the rotor to engage a keyway and simultaneously align 24 shear pins with mating holes in the stator frame. The power plant uses open-deck construction, and will contain 13 turbine-generating units. The gantry is 70-ft high, 63-ft wide, and 95-ft long bumper to bumper, and stands on 24 wheels which carry it along steel rails.

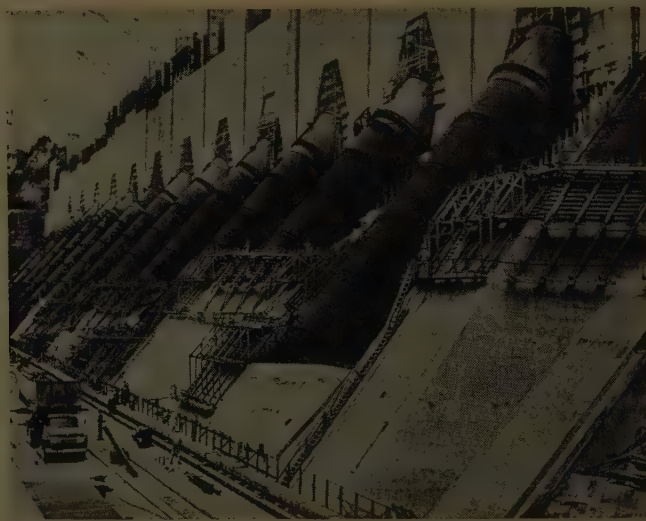
Meanwhile, Gulf States Utilities awarded a contract to Bailey Meter Co. for a solid state Bailey 750 information system with magnetic drum programming and digital computer for performing all computing functions. The system will be installed at the Sabine Power Station in Orange County, Texas.

Expand Hot-Dip Galvanizing Research

A research and development campaign to expand the uses of hot-dip galvanizing will be launched soon by the American Zinc Institute and the American Hot Dip Galvanizers Association. Purpose of the cooperative campaign is to stimulate research and experiment by architects, engineers and technical experts in many fields where hot-dip galvanizing is not being utilized to its fullest potential, as well as to encourage product improvements.

Dishwasher Good for Meters, Too

Consolidated Edison's summer campaign promoting the theme, "Don't Be a Dishwasher . . . Buy One!" did a selling job in an unexpected field. Right in the middle of the campaign, the electric division of the meter bureau bought a dishwasher, and some detergent, and went all out for the mechanical method of washing the glass covers of electric meters that come in for repairs. The new restaurant-type dishwasher cleans upwards of 300 covers an hour.



Concrete encasement of 13 Robert Moses Niagara Power Plant penstocks is shown in various stages of completion. Upper and lower elbows of the 462-ft long, 24-ft diameter tubes have already been enclosed and anchored in concrete. This phase of the operation involves concreting the remaining 210 ft of each penstock. Steel cantilever forms—specially designed and fabricated by Blaw-Knox Co.—are being used to place concrete in 10-ft lifts. Each lift requires about 425 cu yds of concrete. Concrete cures 12 hours or more before forms are stripped and repositioned for the next lift.



Tie Back Reduces Auger Hazard

By L. D. NALLEY
Transmission & Distribution Foreman
Ohio Power Co.
Waynesburg, Ohio
AEP System

A simple tieback reduces much of the hazard from a swinging auger during pole setting or at other times, when the earth auger is out of its cradle but not in direct use. It also eliminates the need to steady the auger when moving the truck near energized lines. Formerly, such hazards would arise after a hole was dug and the pole was being hoisted and moved into position for setting, especially where the ground was hilly or uneven.

The tie back (or sling) shown was made from 5/16-in. wire rope and other available materials. The loop is first placed around the auger. Then the 5½-in. anchor hook is attached to the pintle hook or some other convenient point on the truck so that it pulls the auger back far enough to be out of the work area. Whenever the auger is to be used, the loop can easily be removed. We have used this idea for 6 mo. and find it a convenient and desirable improvement.

Rebuilt Aspirating Doors Save \$63

By K. ENGLISH, Master Maintenance Man
and E. HUNTLEY, Maintenance Foreman
Kammer Plant
Captina Operating Co.
Cresap, W. Va.
AEP System

Aspirating doors and extension pipes (for direct viewing into the boilers for inspection of combustion and slagging conditions) have been rebuilt at our plant at a saving of approximately \$63 each. About 15 replacement doors are normally required per year. Excessive erosion makes an inspection door inoperative in about that time.

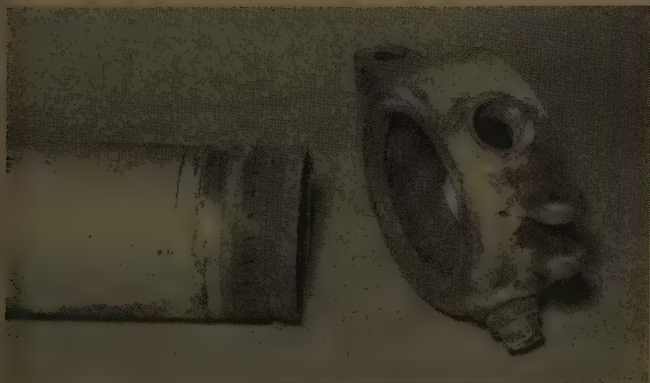
The rebuilding procedure is as follows: First remove the old aspirating hinged door and chuck the extension pipe in a lathe. The door casting is carefully separated from the extension pipe by machining at the welded joint. A new section of standard 3-in. pipe, slightly longer than the old extension pipe, is



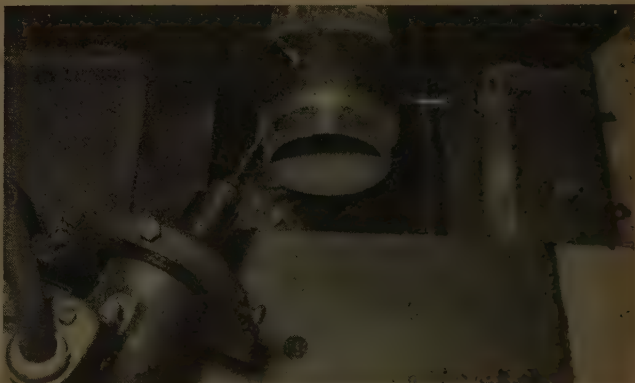
Wire rope sling or tie back can be readily made from standard materials, using this as a guide. Length of sling will depend on rigging technique, but should be short enough to remain in tension when truck slopes forward.

then chucked in the lathe. A ¼-in. drill is mounted on the tool post of the lathe and set at the correct angle to drill holes into the extension pipe. A short piece of pipe which just slips over the extension pipe is used as a jig to aid in the drilling. Three machine screws are threaded into this short pipe or collar to tighten it securely in place as shown in the photos. As the proper size holes are drilled, the extension pipe is indexed the correct amount so that holes will be properly spaced around the periphery. After all holes are drilled, the extension pipe is cut off to the correct length.

The new aspirating pipe can now be welded to the original door casting, and the rebuilt door is ready for installation. Once the first rebuild has been completed, the drilling collar can be used as a drill jig giving correct spacing of the holes for future rebuilds.



Eroded aspirating pipe removed from old door casting reveals holes for air entry.



Drilling setup used by author to duplicate specified hole locations and angle-of-entry.



Fig. 1—Primary capacitor termination for submerged service with taped 5-kv bushings.

DISTRIBUTION CAPACITORS GO UNDERGROUND IN PHILADELPHIA

Subsurface capacitors prove practical and economical for underground and congested overhead distribution.

WHEN IT became apparent that the addition of capacitors on overloaded distribution circuits was a necessity the Philadelphia Electric Company engineers decided to make use of vaults rather than poles to install many of the capacitor banks.

No capacitors were installed by the Philadelphia Electric Company prior to the heat storm of July 1955, except for voltage improvement of 4-kv circuits supplying suburban areas. Approximately 85,000 kvar of capacitors were installed up to that time, consisting mainly of 90-, 150- and 225-kvar banks which are made up of 15- and 25-kvar units.

The system peak load during the summer of 1955 was 1920 mw at 82.6 percent power factor or 2330 mva. This peak was four percent less than the previous winter's peak of 2000 mw while the mva was approximately four percent higher. Some of this increased load resulted in overloaded distribution circuits, high temperatures in conduit lines, overloaded substation transformers and supply lines—mainly in the City of Philadelphia.

During the summer peak in 1955, the coincident one-hour demand of the load in the Central District of Philadelphia (an area of 14 sq miles) was 208,000 kva; of which 76,000 kva was served directly at 13.2 kv; 83,000 kva at 2.4-kv two-phase and 49,000 kva by 2.4-kv two-phase loop circuits supplying 60,600 kva of network transformers feeding two-phase, five-wire 120/240-v mains.

These loop circuits fed into three network areas, each area supplied by five loop circuits from each of two substations. The 72 percent power factor of the network load prior to 1955 during the maximum load period warranted installation of secondary capacitors, but nothing had been done due to the high temperatures in the transformer man-holes and the extensive and costly

Editor's note: This is the essential text of a paper presented at the Sangamo Workshop Seminar at Springfield, Illinois, November, 1960.

remodeling necessary to accommodate them.

Capacitors Go Underground

The many air intakes covered by gratings in the sidewalk areas to supply air to the transit subway system and the gratings over light and ventilating wells gave birth to the idea of installing the capacitors directly in the ground with a grating cover. In this manner the absolute minimum space would be required and naturally the least costly job.

In September 1955, test installations of 90-kvar underground secondary capacitor banks were made at six locations in the mains of one network in the congested downtown area. The ease with which the installations were made, together with the power factor improvement, warranted the adoption of the method used. Since then a total of 372 installations have been made on network and radial mains.

The management of the Company was not satisfied with installing pole-mounted 2400-v capacitors in congested or built-up areas due to unavailability of poles at some locations, need for premium labor in making overhead installations because of pole renewals, and the hazard created by cluttering poles with as many as twelve 25-kvar capacitors. Furthermore, installation of capacitors on poles did not improve the appearance of the pole lines. With the introduction of the 50-kvar capacitor in the fall of 1955, and with the successful submersible installation of secondary capacitors, a study was started to adapt the primary capacitor for possible submersible operation.

To date, 539 subsurface primary capacitor installations have been made as compared to 380 pole-mounted installations during the same period. A total (primary and secondary) of 911 subsurface capacitor installations have been made on the Philadelphia Electric System so far.

A tabulation of capacitor installations on the Philadelphia Electric Company system as of September 1, 1960 is shown in Table I.

Objective

An attempt is made here to explain the techniques developed for

economical physical installation of subsurface capacitor units rather than the engineering justification for capacitors. This explanation is divided into two parts, namely, Secondary (240-v) Capacitor Installations and Primary (2400-v) Capacitor Installations.

Secondary Installations

Six 15-kvar capacitors making up the 90-kvar banks were already designed for submersible operation by having each terminal equipped with a clamped and water-proofed rubber hood. The capacitors were purchased with one polarity fused and with six 15-kvar capacitors wired for connection to four 350-mcm two-phase mains.

Most of the underground mains were in the roadway close to a curb. The capacitors were designed to be

connected to the mains in the approximate electrical center between network transformer banks.

A construction crew, with the necessary mobile equipment, excavates approximately two cubic yards at a location immediately adjacent to the curb and build a 2-ft x 5-ft x 3-ft (inside dimension) subsurface housing constructed with pre-cut two-in. Penta-treated yellow pine lumber. The hole is excavated to a four-foot depth and a layer of 0.75-in. stone is placed at the bottom. A steel frame is placed on the top which supports the grating cover. A fiber-duct connection is made to an adjacent manhole or, more often, to a splicing ditch excavated in the sidewalk area over the secondary service cables.

The construction crew installs four single-conductor 350-mcm, rubber and neoprene, 600-v cables

TABLE I
CAPACITOR INSTALLATIONS ON THE PHILADELPHIA
ELECTRIC COMPANY SYSTEM—SEPTEMBER 1, 1960

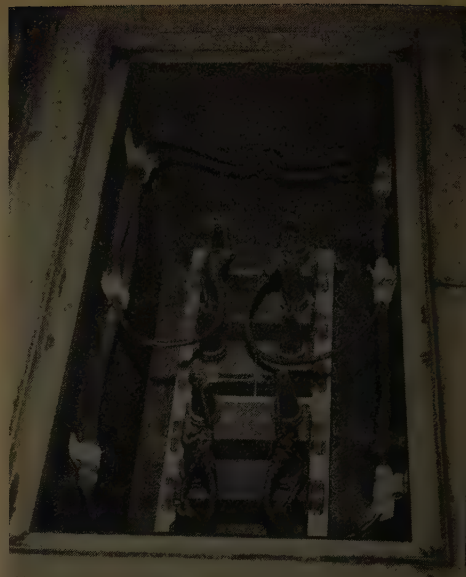
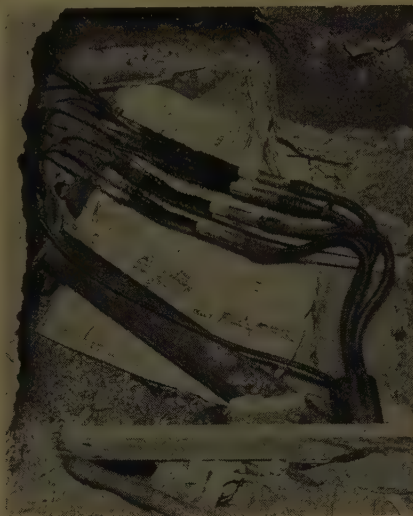
	Philadelphia		Suburban	
	2-Phase Circuits Kvar	3-Phase Circuits Kvar	3-Phase Circuits Kvar	Total All Circuits Kvar
Overhead				
2400-V, 15 Kvar Pole Mt.	—	180	5,745	5,925
2400-V, 25 Kvar Pole Mt.	450	11,375	67,400	79,225
Sub Total	450	11,555	73,145	85,150*
2400-V, 6-50 Kvar Pole Mt.	—	11,100	102,900	114,000
240-V, 3 Kvar Pole Mt.	—	—	138	138
240-V, 5 Kvar Pole Mt.	155	—	160	315
240-V, 7½ Kvar Pole Mt.	4,500	—	—	4,500
240-V, 10 Kvar Pole Mt.	10,500	—	—	—
Total	15,605	22,655	176,343	214,603
Underground				
2400-V, 6-50 Kvar Undg. (Bushing Taped)	52,200	9,000	4,500	65,700
2400-V, 6-50 Kvar Undg. (Compound Filled)	—	30,900	21,900	52,800
2400-V, 3-100 Kvar Undg. (Compound Filled)	—	32,100	11,100	43,200
240-V, 6-15 Kvar Undg.	29,340	—	—	29,340
Total	81,540	72,000	37,500	191,040
Substation				
2400-V, 18-50 Kvar	—	—	59,400	59,400
GRAND TOTAL	97,145	94,655	273,243	465,043

*Installed Prior to September 1, 1955



Vault with a typical secondary capacitor bank installed

Typical connection made between capacitor bank cables and supply mains.



Completed connections made to secondary capacitor bank.

and a 2/0 covered neutral wire between the capacitor housing and the secondary service cables or mains. Replacement of paving around the new housing is made and the splicing ditch is decked over, barricaded, and red-lamped. This completes, for the moment, the construction work; two such locations being done per day by the same crew.

A splicer and helper with tool cart then make the connection of the capacitor cables to the supply mains. In the case of rubber and neoprene cable mains splicing requires less than one day, while in the case of paper and lead mains it usually takes about a day and a half. The splicing being completed, the construction gang returns and protects the newly-made splices, backfills, and completes the necessary paving.

Normally after eight manholes have been completed and the supply cables energized, the Transportation Division crew picks up, delivers and installs the capacitors, using a truck and a hydro-crane.

A splicer and helper with a light truck are then assigned to complete the installation of the capacitor bank. The splicer tests the six individual cells and also checks for tight connections of both the electrical fittings and the rubber weather guards.

The four electrical connections at

the capacitors are made to the previously energized leads. When completed, each capacitor is checked for proper current flow.

The work is completed when the splicer installs a piece of corrugated transite over the capacitor bank. It is supported on two pieces of reinforcing rod spanning the housing and stapled to its sides. This serve to catch refuse and avoid damage to the rubber weather hoods as might result from lighted cigarettes or probing through the grating.

The cost for a submerged secondary capacitor installation (excluding the cost of the capacitors) averages \$5.18 per kvar.

Primary Installations

As stated before, the 50-kvar size of capacitors was introduced in the fall of 1955. These capacitors had a 5-kv porcelain bushing, and it was decided to tape this bushing similar to Fig. 1. Tests were made in 1955 on a sample taped bushing immersed in water overnight and, after having voltage applied at 5, 7.5 and 10 kv for two hours successively and, then, increased 1 kv per minute, the test specimen broke down at 38 kv.

Specifications were prepared for the manufacturers to furnish six 50-kvar capacitors with the polarity

bushings taped and wired for two-phase (three capacitors per phase) or three-phase (two capacitors per phase).

The same type of construction was planned for the 2400-v capacitors as was used for the 240-v utilizing pre-cut two-in. treated wood to form a housing 3.5-ft wide x 5-ft long x 2.5-ft deep, with a metal grating top. The capacitors were placed on their sides for better ventilation and to keep the costs down by using a shallow excavation.

A manufacturer furnished two 300-kvar banks in February, 1956, for temperature tests, and they were installed in subsurface housings. A number of minimum-reading thermometers were installed and, while this method has some limitations, test data gathered in the spring of 1956 was sufficiently satisfactory to place orders for delivery of some 45,000 kvar of capacitors. A recorder for 16 thermocouple positions was put into service early in July and continued through September, 1956. The maximum temperature recorded for the hottest day on the case of one capacitor reached 70 C with an ambient of 43 C. It is also interesting to note that the use of forced air did not appreciably reduce the temperature.

The taped bushings were not to our liking, and pressure was put on the manufacturer to develop



A standard 2400-v submersible capacitor bank installation. Note: Metal housings are installed over the bushings.

something of a more permanent nature. Two years later the manufacturer developed a metal housing over the bushing, filled it with compound and reduced the bushing rating from 5000 v to 1200 v.

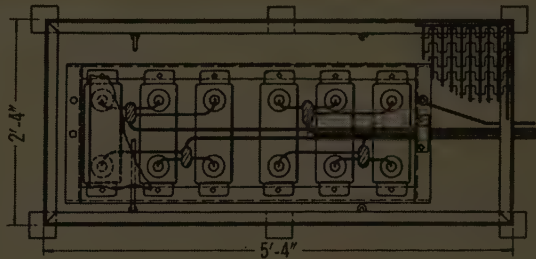
While the new compound-filled metal housing was an improvement, the complicated splicing of capacitor banks still created a problem. If 100-kvar units were available, the splicing could be greatly simplified. Again the manufacturers came through with a design of 100-kvar units in the latter part of 1958 in time for 1959 installations.

The primary subsurface capacitor installations are prepared much in the same way as the secondary installations except that a fiber-duct and iron-pipe-bend connection is made to the pole and an eight-ft length of iron pipe is extended up the pole. On the average, two locations can be completed per day by one crew.

The cost of installing 100-kvar primary capacitor banks (excluding the cost of the capacitors but including the terminal-pole connection) is \$2.14 per kvar.

The subsurface capacitor installation is a practical and economical means of providing needed kilovars in underground distribution areas and locations with congested overhead distribution.

A completed primary capacitor installation with grating installed over the vault.




Standard drawing for the installation of a 240-v 90-kvar capacitor bank.

"FREQUENCY-ZERO" MEANS NO ACCIDENTS

Utilities can hit frequency-zero in accidents by eliminating mistakes in planning, construction and operation.


By S. M. SHARP, Vice President,
Engineering - Operations, Southwestern Electric Power Company

Slogans Insufficient



Operating personnel in utilities keep hearing these safety slogans: "Reduce accidents," "Cut down the number of deaths," "Let's save lives," etc. These slogans sound good but some questions must be answered in order to carry out safety programs in actual operation, such as: "How do you attempt such a reduction in deaths?" "Which type of accident should we attack?" "What types of accidents are less harmful and therefore do not warrant our major concern?"

Goal



Many times confusion is permitted in one area in order to combat it in another. This emphasizes the fact that the safety problem can not be settled piecemeal. Rather it is a philosophy that should begin with the original plans of a job and continue so long as operation is maintained. The goal must be accident elimination, not just reduction. We should set our sights on frequency-zero and nothing less.

Standards Used

In order to protect the employees of the company and the general public the Southwestern Electric Power Company uses three important standards. They are:

1. The National Electrical Safety Code
2. The Safety Rule Handbook
3. Engineering and Construction Standards

National Electrical Safety Code

The NESC was prepared by the National Bureau of Standards and Department of Commerce in cooperation with many companies and organizations. This code is kept up to date and revised from time to time. The Sixth Edition was ap-

proved June 8, 1960, and is now being printed. Revision is a slow process because so many people and associations are involved. One must keep in mind that all the requirements of this code are *minimum*.

Rule Handbook

The Safety Rule Handbook is published by the Bureau of Safety, a subsidiary of Middle West Service Company.

This handbook is divided into four parts:

1. General Rules for all Employees
2. Electrical Departments
3. Generating Stations
4. Electrical Transmission and Distribution

With the help of the people in companies associated with the Bureau of Safety, the Safety Rules are revised periodically to keep abreast of the changing conditions and improvements in equipment and procedures.

Engineering and Construction Standards

The personnel of the SWEP Co. have designed their own Engineering and Construction Standards with both safety to workmen and safety to the general public in mind.

These standards call for conformity with a basic over-all plan or design that grows out of past experience as well as technical theory. In other words, they call for doing things the "best way" from a broad viewpoint, and the "best way" has no leeway in it for accidents.

Compliance with Rules

We find that we can achieve the best results in compliance with rules and standards when the employees involved are informed as to why the rules have been placed in effect. When it is learned that there is a sound basis for these restrictions, it is very likely that good acceptance will follow.

As we approach the subject, we must also recognize the very basic

EVERY possibility of injury can not be removed, but good habits and safeguards can be developed by standardization. Also, standards that provide frequency-zero in accidents usually result in economies of construction.

Editor's Note: This is the essential text of a paper presented at the National Safety Congress at Chicago, Illinois, October, 1960.

factor that it is the desire on the part of individuals to do things in their own way. They look upon rules and standards as infringements on their own personal liberty and, therefore, something they should naturally oppose. This is all the more reason for the close cooperation between engineering, construction and safety to obtain the soundest possible plan from every viewpoint.

Double Victory Possible

Frequency-zero means no accidents, and no accidents mean no mistakes in planning, construction or operation.

It all starts in the planning stage with a standards program. The general conception of a standards program is that it is a means to provide economy or save money. If we can provide a means to preserve life and at the same time effect economies, we have achieved a double victory.

Requirements for Standards

While an engineering and construction standard must provide basic safety requirements, it must also provide the economy that results from use of standard materials, standardized assemblies and standardized work methods and procedures. It must also be designed to provide the minimum in future required maintenance and to continually provide improved service to our customers.

It would be simple to provide a design that would meet only the first named safety requirements—that is, Safety To Our Employees and Safety To The Public. By taking into account these two requirements and ignoring the other reasons, it would not be hard to see how the costs could increase to the point where you could “safety design” yourself out of business. This does not mean you should compromise safety but it is necessary to incorporate all of these reasons into each design to have both an economical and safe structure on all viewpoints.

The same type construction used



Mr. S. M. Sharp (left) is discussing the “Standards” with a line crew. They are: (left to right) A. R. Russell, J. N. Deaton and E. L. Steinhauser.

throughout a company not only provides economical benefits available from larger quantity purchases, etc., but also provides a very valuable safety feature. When it is necessary to bring crews from other divisions to emergency areas, they are familiar with the type of construction and know the best work methods to apply. This certainly can be demonstrated during any severe wind or ice storm. This uniformity really pays off in reduced labor costs.

Birth of Standards

An attempt is made to give everyone in SWEP Co. who uses our standards a part of their development. The need and idea for a new standard might well be brought up by a line crew foreman or a member of his crew, by a service man, by a meterman, by an engineer or by a supervisor of construction.

After the initial design is made by the engineering department, a mock “set up” is often made and this is analyzed from both installation procedure and future operating requirements. From this analysis, such changes as necessary are made and the proposed standard is then circulated to each division engineering and operating department and the general safety department.

The drawing and specifications with suggested changes are then returned to the general engineering department for incorporation of the new ideas and necessary changes.

The revised-proposed standard is then returned to the divisions to be used in making actual installations. These installations are then field checked by the safety department engineers, the divisions engineers, design engineers, and the division operating and construction supervisors. After this field trial and check period, any necessary changes are then incorporated into the final approval standard.

All through this development, the safety department has been providing assistance—in the original comments, in the observance of work methods, on the “mock up” and in the final stages of approval. An approved standard should include the approval of the Safety Director or his representative. The safety man must gain and hold his place at the planning table by *trying* to see the engineer’s problem and selling a good solution—not by just bucking in a negative manner.

Provisions must be made in a standards program for revisions or changes as the various conditions of safety and economy demand. It is essential that they be reviewed to make use of new materials or changes in methods. At SWEP everyone connected with the use of standards is encouraged to submit ideas and suggestions on improvements. If a revision “set up” was not included in such a program, the advantages of a standards program would soon be lost.

(Continued on page 124)

PRODUCTIVITY RECORDS LEAD TO BETTER CREW MANAGEMENT, PERFORMANCE

Knowledge of time use helps gauge correct crew sizes for specific jobs, pinpoints training needs, and helps evaluate equipment used in line work.

By C. E. MONFORT, Jr.
Manager, T&D Construction Department, Union Electric Company

IN LINE CONSTRUCTION and maintenance, where most T&D dollars are spent, it is necessary to know what to expect from work crews in the way of performance and productivity. Such knowledge makes it possible to measure performance of crews of various sizes, single out foremen and crews that are lagging and may need coaching, and to better appraise labor-saving devices used in line work. It is also valuable information to have when preparing budgets.

Since 1955 Union Electric has measured crew productivity in terms of productive manhours, i.e., doing the things for which the crewman is paid, as opposed to non-productive manhours such as travel time, vacations, sick leave, holidays, training, etc. This approach has proved sound and it is now being extended to other T&D activities.

Crew Manhours

For the 12 months ending June 1960, the average crewman spent 16.3 percent of his available working time driving to and from or between job sites, 3.1 percent in loading and delays, 8.3 percent of his time idle because of inclement weather, 1.5 percent of his time attending meetings and getting instructions, and 12.5 percent of his time on vacation, sick leave, or in-

active because of holidays. Only 58.3 percent of his time was spent in productive line work, including overtime which has a higher productivity ratio than straight time. Straight-time productive manhour ratio for this period was 57.1 percent.

Timing units in terms of productive manhours were established for the installation and removal of each item of material used in line construction, maintenance, and operation. Units are modified when found to be inadequate or too generous. Timing units have recently been added for wire stringing to reflect efficiencies of new wire stringing equipment.

Timing units are intended to represent time in productive manhours required to perform specific jobs under average conditions. Crews are expected to better performance over that represented by the standard timing under favorable conditions. However, a job estimate may be exceeded when conditions are adverse. While we make no brief for the accuracy of the timing units, experience has proven that the system of timing units is basically sound.

Cost Per Productive Manhour

An estimate is prepared for each construction or removal job. The

estimator notes the number of each operation with its timing unit on the estimating form and enters the extension in the appropriate account column. Columns are totaled and productive manhours are priced at the current productive manhour cost for management surveillance and approval of the work-order application. Approximate cost per productive manhour for a seven-man crew, for comparison only, is as follows:

One-sixth crew wages per payroll hour including foreman's salary	\$3.732
Proportionate part of driver's loading time	.048
Cost per payroll manhour	\$3.780
Divided by current straight-time productivity (57.7%)	\$6.55
Social Security and Pension Costs	.64
Transportation Costs	.54
Tool Costs	.47
Cost per productive manhour	\$8.20

The first item, \$3.732, is derived by adding hourly rates of all crew members, including the foreman, and dividing the sum by six, the number of manual workers. Thus, the foreman's salary is represented as an overhead cost.

The truck driver reports one-half hour earlier than other crew members to load materials to be used that day. The figure \$0.048 represents the proportionate part of this loading cost.

The \$8.20 cost per productive manhour includes only first-line supervision. As many other fringe cost items have been omitted for the sake of simplicity, the figure is only approximate.

Reports

In his daily work, the line crew foreman keeps a running log which indicates both productive and non-productive time intervals on jobs he worked that day. The log is used in preparing the crew daily time report which also shows productive and non-productive time, crew members absent and the reason, etc.

No accounts are shown on the

daily time report since productive hours worked on each job are allocated by office personnel to each account in the proportion they bear to the total as shown in the estimate. For example, if 20 percent of the estimated hours for a job are in the conductor account, 20 percent of hours worked on the job are charged against that account.

Non-productive time is similarly charged to the appropriate account by office personnel.

Performance Analysis

From a rack up of crew time reports, performance of each crew can be determined by comparing actual vs. estimated manhours. This information is published in chart form for each crew at the end of each quarter. See Fig. 1.

Solid lines on this chart represent performance for the last 12 months; dotted lines represent performance for three months. The 12-month record is the important one because one exceptionally good or bad performance will distort the quarterly record but average out over a year.

It may be seen in Fig. 1 that the foreman's performance for a single quarter varied from 20.9 percent below estimate in the first quarter of 1959 to two percent above in the third quarter of 1959. On a 12-month basis, however, his performance varied little over the last six quarters.

The charts are one of the means used to evaluate foremen and point out those in need of additional training and counseling.

At quarterly intervals, performance of each of the company's overhead districts and the entire division is calculated. So far the record has shown a continual improvement.

Crew Size

Until early 1959 all line crews were nominally seven-man crews. Because of absences due to illness or other reason, however, many crews contained only five or six men much of the time. This led to formation of one five-man crew in each district and a reduction in a number of other crews to six men. One reason for this was to form a pool in each district to compensate for normal absences and thus keep

TABLE I
MANHOUR COSTS FOR VARIOUS SIZE CREWS—STRAIGHT TIME

Crew Ave. Size—Men	Cost Per Payroll M.H.	Percent Of Time Productive	Cost Per Productive M.H. Performed	Performance Ratio	Cost Per Productive M.H. Performed
5 (foreman, driver, 3 linemen)	\$5.38	54.6	\$9.86	.813	\$8.02
6 (foreman, driver, groundman, 3 linemen)	4.94	56.9	8.69	.939	8.16
7 (foreman, driver, groundman, 4 linemen)	4.73	57.7	8.20	.945	7.75
3 (1 leader lineman— 2 linemen)	4.38	52.7	8.33	1.034	8.61

TABLE II
MANHOURS WORKED BY JOB SIZES—1959

Job Size	Percent of Total Manhours Worked	Manhours Worked
1-20 Manhours	5.8	26,100
21-30 Manhours	3.9	17,600
31-50 Manhours	6.4	28,800
51-100 Manhours	10.8	48,600
Over 100 Manhours	73.1	328,900
Total	100.0	450,000

PRODUCTIVE MANHOURS AVAILABLE BY CREW SIZES

3-Man Crew	14 Per Day	3000 Per Year
5-Man Crew	21 Per Day	4500 Per Year
6-Man Crew	26 Per Day	5600 Per Year
7-Man Crew	31 Per Day	6200 Per Year

TABLE III
WORK REASONS USED IN OVERHEAD LINE CONSTRUCTION

Work Reason No.	Description
1	New Business
2	Change in Load
3	Street Lighting
4	Transformer Changes
5	Substation Line Projects
6	Conversions to 12 KV
7	Line Additions and Reinforcements
9	System Integration Projects
11	Storm Damage Repairs
12	Repairs of Damage Caused by Public
13	Defective Equipment Replacement
14	Defective Poles Replacement
17	Relocations at Customer Requests
18	Relocations at Government Requests
19	Relocations at Bell Request
20	Rearrangements for Engineering Reasons
21	Street Clearance Projects—City of St. Louis

In order to secure accurate cost records of the various size crews all five-man crews and about one half of the six-man crews were kept at assigned strength by substituting men from other crews. In addition, at the beginning of 1960, two three-man crews each consisting of three linemen were formed as an experiment. Although this is a high-cost crew size, it was felt that there was a place for a limited number of them.

The relatively high cost of the six-man crew was due to our practice, through most of this period, of working about half of the crews at their assigned strength regardless of their work assignment. Many of these jobs would have been performed more efficiently if crew size

Lately, as an experiment, the groundman in some of the six-man crews has been replaced by another lineman. Although this increases the productive manhour cost slightly, we feel that additional flexibility as a result of operating with a fourth lineman will improve overall crew performance and lower cost per unit of work performed.

Data given for three-man crews covers only six months of the year and is, therefore, inconclusive.

In spite of their higher unit costs

Manhours Worked by Job Size

For minimum overall driving time, all of the 1-20 manhour jobs should be worked by five-man or smaller crews. For example, nine three-man and six five-man, or similar, crews would be needed to handle the 1959 work in this category. Jobs in the 21-30 manhour class

(Continued on page 125)



**"How do you feel
Savings Bonds match up
against common stocks as
an employee investment?"**



"You really can't compare the two, Jimmy! As you know so well, every good investment plan needs a sound backlog of basic safety and you need some savings before you branch out with anything else. Now, we don't know of ANY sounder, safer form of saving than U.S. Savings Bonds. We felt we were doing our people a real favor by asking our State Savings Bond Director to help us explain the Payroll Savings Plan to every person on our payroll.

"Until we put on this company-wide campaign, lots of people in our company had no idea they could set up a regular, *automatic* savings plan by just signing one card. They welcomed having someone to answer their question *in person*, and it appealed to their pride to be made a part of the company group contributing to our country's economic welfare.

"And, Jimmy, here was another thing we found out. Many of our employees didn't realize that since U.S. Savings Bonds now earn 3¾% they are the best investment they have EVER been!"

Perhaps there are employees in *your* organization who don't know what a splendid base for family savings U.S. Savings Bonds really are. Perhaps they don't realize how easy it is to start NEXT PAYDAY with regular, systematic savings for important future goals.

Your Savings Bonds Director has a fine background of experience in presenting the Payroll Savings Plan. For fast, understanding help, get in touch with him now. Or write Savings Bonds Division, U.S. Treasury Department, Washington, D. C.

NOW! U. S. SAVINGS BONDS EARN 3¾%

ELECTRIC LIGHT and POWER



THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTISM, THE ADVERTISING COUNCIL AND THE DONOR ABOVE.

Electric Light and Power, March 15, 1961

STORNORRFORS SWEDEN'S LARGEST HYDROELECTRIC POWER PLANT

This plant with a 246-ft head was built completely underground in solid rock at a cost equal to 110 U.S. dollars/kW. Ultimate capacity is 500 MW.

ABBREVIATIONS

appearing in this article correspond to European practice, as follows:

kV	—	kilovolt
kW	—	kilowatt
kWh	—	kilowatt-hours
MW	—	megawatt
MVA	—	million volt-amperes

UNDERGROUND HYDRO-ELECTRIC POWER STATIONS

In about 1889, what may have been the world's first underground hydro-electric power development was installed in one of the mines of the Comstock Lode at Virginia City, Nevada. Designs and techniques have gradually improved during the past 50 years and there are now almost 300 underground hydro-electric power stations either in service or under construction, the total installed capacity of which will be some 31,000,000 kW of installed capacity.

Underground plants have been widely built in Norway, Sweden, Switzerland, France, Italy and Yugoslavia. They have been constructed in at least 29 countries and this number will soon be increased. In places where underground hydro-electric plants can be adapted to satisfy geological and economic requirements, neither geography nor climate affect their use.

Ref.: WATER POWER, July, 1959

THE STORNORRFORS plant (Sweden's largest hydroelectric power plant) was built underground in solid rock at a cost much less than most of the above-ground hydroelectric plants that have been built recently. Besides being unique with respect to cost this plant features the world's largest tailrace tunnel—about 4200-sq ft cross section.

This mammoth rock-excavation project is located in northern Sweden on the lower reaches of the Ume river. This river has a mean waterflow of about 15,890 cfs, which is approximately equal to the flow of the Connecticut river.

The first stage of the Stornorrfor plant was completed in 1959 with a rated capacity of 375 MW. The ultimate capacity of the plant is 500 MW with a head of 75 meters (about 246 ft).

Three Falls

The water rights for two of the three falls comprising the head for the Stornorrfor plant were acquired by the State Power Board during the period 1917-19 with the town of Umea entitled to a share of the energy produced. In the 1940's the town of Umea and the State Power Board acquired the water rights for the third falls.

A 26-MW plant (Norrfor) was built at the upper falls in 1926. As late as the 1940's plans were being made to develop only the two upper falls, whereas the lower-fall section was to be exploited separately. By the 1950's technical progress had advanced to a stage that it was considered possible to harness the whole of the falls in a single installation.

Installed cost of the first stage of

this plant was about \$41.25-million or \$110/KW.

The town of Umea shared 11 percent of the cost and is entitled to 16 percent of the total production of the plant. According to a supplementary agreement the State Power Board will get all of the power produced until 1975 at which time the town of Umea will begin receiving its share of the power produced.

Norrfor Plant Flooded

The Norrfor plant was flooded and, therefore, became inoperative when the new Stornorrfor plant was built.

Top water level was about 230 ft above sea level when the Norrfor power plant was in operation. The decision was made to raise the pool level to 246 ft for the Stornorrfor plant.

The 246-ft head lies in a section of the river about 25 miles long—see Fig. 1. The preponderating part of the head (about 236 ft) is confined to a section of the river only about eight miles in length.

Number Of Stages

Investigations were restricted to a choice between projects comprising one or two power stations. To enable the comparisons to be made with a maximum degree of accuracy, exhaustive investigations were necessary bearing on those parts of the installation which might be assumed to play a decisive role, such as the blasting of rock tunnels as compared with concrete works, the size of the units and type of turbines. The single-plant alternative was found to have an installed cost approximately six percent less than the two-plant alternative.

The difference in construction costs plus the capitalized annual costs were estimated to be \$14-million less for the single-plant alternative than for the two-plant alternative.

Ultimate Capacity

The Stornorrfors plant is located on the Ume river below its confluence with the Vindel river. The main branch of the Ume river will soon be relatively well regulated, but the problem of determining installed capacity was complicated by the fact that the Vindel river is not regulated.

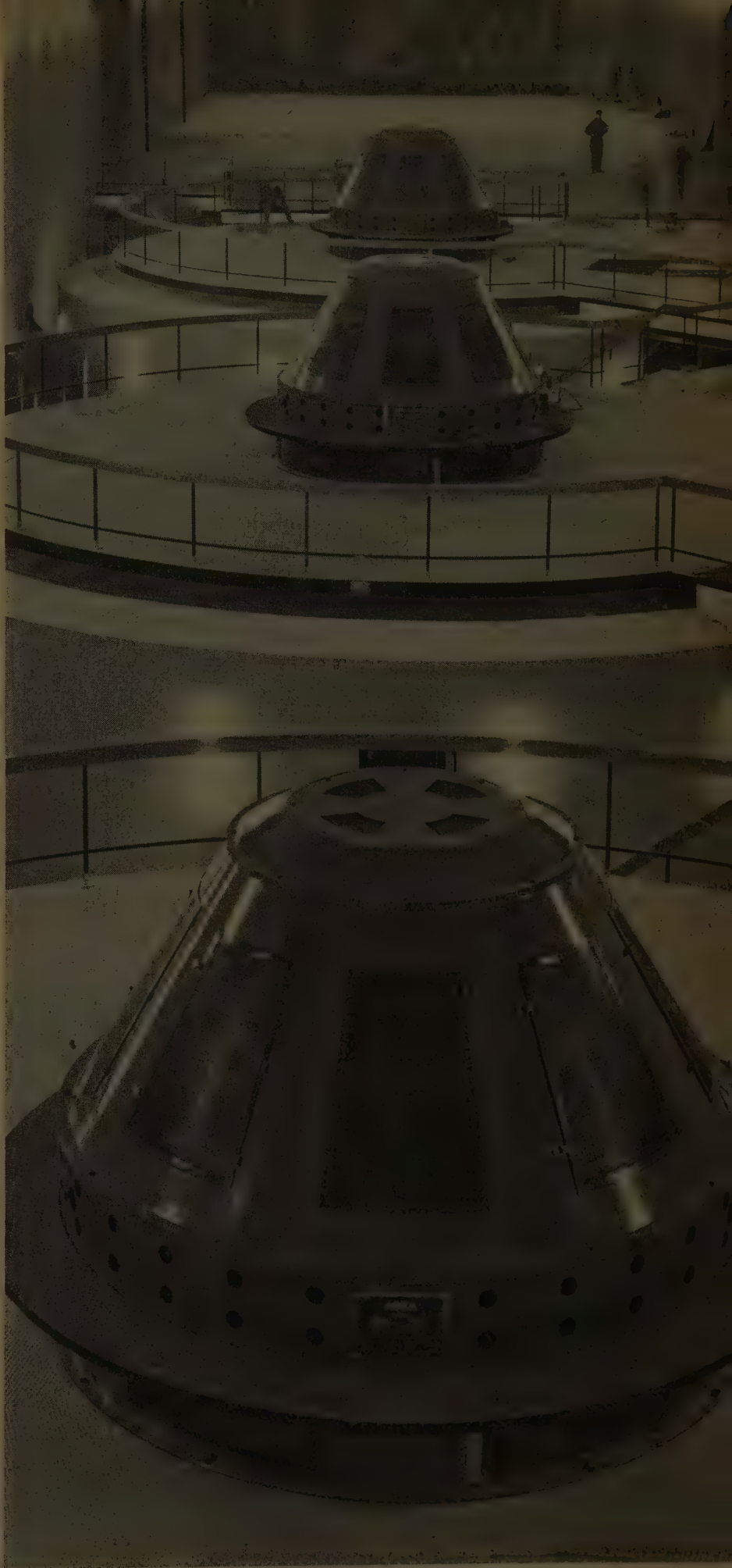
Using customary assumptions it was decided a development using the maximum flow of 21,186 cfs would be economically justified without regulation of the Vindel river. With regulation of the Vindel river the maximum flow could be increased by 7,062 cfs to 28,248 cfs, and the station capacity could be increased by 120 MW. The decision was made to undertake the development of Stornorrfors in two stages. Certain preliminary arrangements were made for the second stage which will be completed when and if the Vindel river is regulated.

Turbine Selection

It has been customary heretofore to employ Francis turbines for the high head plants, particularly for such a large flow as in this case, but a study revealed that Kaplan turbines would provide a larger capacity and an increased annual output of some tens-of-millions kWh. This economic advantage was over-ridden by the disadvantages of poor frequency control and slow regulation; so the Francis-type turbines were selected for Stornorrfors.

The ratings of the turbines were specified as 134,840 kW with a maximum output of 147,200 kW. Speed of rotation is 125 rpm.

The manufacture of the turbines was different from the usual in that the runners were welded rather than cast in one piece and made up entirely of stainless steel. The ring and hub were cast separately and machined internally up to final di-



The three completed units comprising the first stage of the Stornorrfors plant.

STORNORRFORS

mensions. The blades were also cast and finished prior to their insertion in the runner. The complete runner weighs approximately 70 tons and has a maximum external diameter of about 17 ft and a height of about 9.85 ft. A runner of these dimensions could not be shipped by railway in Sweden so it was shipped by steamer from the factory in southern Sweden to a location near the project site where it was transferred to road trailer for the remainder of the trip.

Electrical Equipment

The generators each have a capacity of 150 MVA with an 18-kV voltage rating. The design power factor is 0.9.

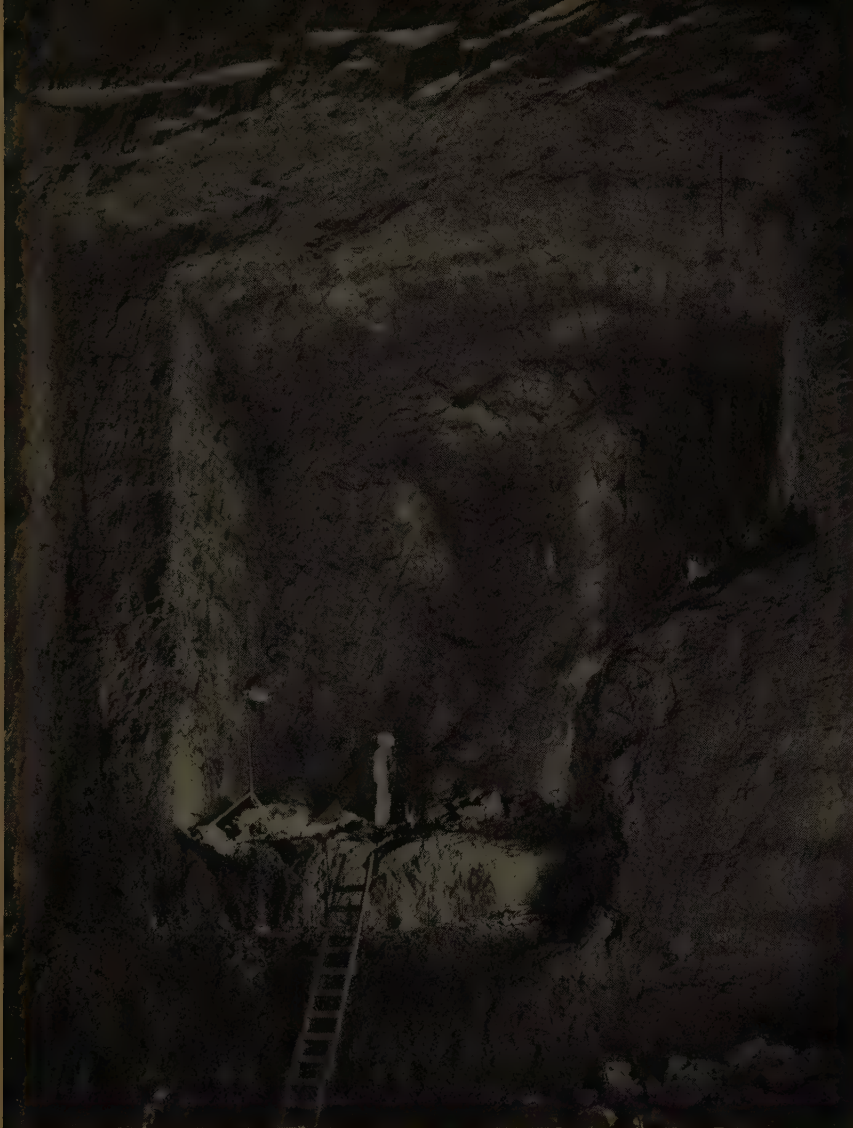
The generator shafts are vertical with the thrust bearings situated under the generators. The bearings are designed for automatic circulation of the lubricating oil, so that external circulating pumps are not necessary. The cooling system is entirely enclosed and the circulating air is cooled in a water cooler placed around the periphery of the stator.

Most of the power from Stornorrfor is stepped up from the generation voltage of 18 kV to the network voltage of 380 kV by means of a transformer bank consisting of three single-phase transformers. A fourth (spare) transformer can be connected in place of any of the three ordinary units during off-peak load conditions by means of isolating switches.

Owing to the large number of power stations operating in parallel on the Swedish high-voltage grid, a brief disconnection of the 380-kV supply from Stornorrfor can be tolerated during the rare occasions on which it is necessary to change the transformers. This fact permits a considerable amount of simplification, particularly in the control equipment.

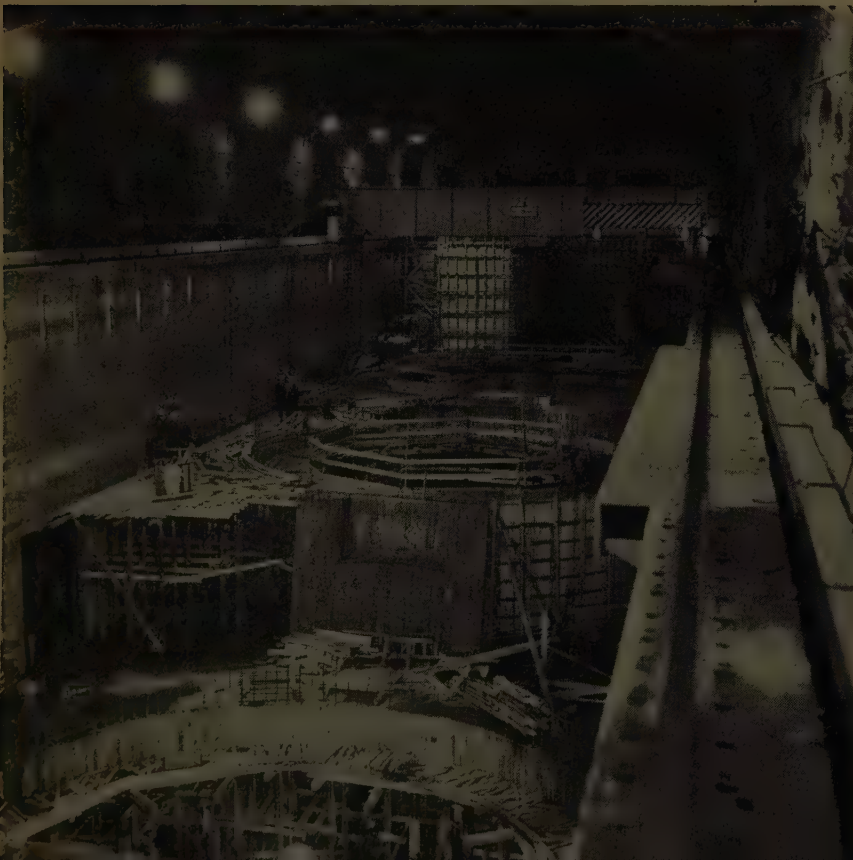
For supplying a nearby city and the adjoining rural district two standard 18/45-kV, three-phase transformers are connected to the generator busbars.

The 380-kV transformers are equipped with built-on cable boxes and the power is sent outside by means of cables. This permits the amount of space required in the



Smooth blasting of the walls for the turbine room.

Internal finish in the turbine room.



transformer room to be appreciably reduced.

The high-voltage cables pass through vertical shafts to connect the transformers to the switchgear at ground level. The copper cross section of the 380-kV cables is 0.628 sq in. with an external diameter of about 4.45 in. To dissipate the losses on high loads the cables are designed for oil circulation and external oil cooling. A pump forces the oil into the lower terminal box, from which it then flows through the hollow copper conductors and cools them. A return pipe leads from the upper terminal box down to the cooler which is connected in front of the above-mentioned pump.

380-kV Switchgear

An investigation concerning the future shape of the Swedish 380-kV network disclosed that it was only necessary to construct a single 380-kV transmission line from Stornorr-fors. It was found, therefore, that the requirements would be met by installing one circuit breaker and a number of isolating switches. Both the circuit breaker and the isolating switches are divided up into separate single-phase units mounted on the four sides of three towers. A considerable saving was rendered possible by employing straight-through cable current transformers in place of conventional 380-kV current transformers.

18-kV Switchgear

The connection between the generators and the 18-kV switchgear is made with bare copper bars, each of which is laid in its own rock tunnel. All circuit breakers and isolating switches on the 18-kV side are mounted in a switchgear room.

Busbars

The two busbars are mounted on a special floor below the circuit breaker room. The busbars are designed for a maximum load of 6400 amps and a damped short-circuit current of 157,000 amps. The copper cross section of the busbars is about 7 sq in. distributed over six bars which are so located that the end bundle of the bars forms the periphery of a rectangular section. To ensure satisfactory cooling, the bars are painted with an experi-

mental red color and wide gaps are arranged for the circulation of the air between the six bars.

The phase spacing is about 3 ft. Full-scale tests have shown that this relatively wide phase spacing is accompanied by the advantage that if arcing occurs between one phase and earth an arc will not be set up between two phases before the earth fault relay has had time to operate. This method for preventing short circuits is cheaper than the method of enclosing each phase in a sheet-metal casing, which is commonly employed in other countries.

Auxiliary Power

The station's own power requirements, consisting mainly of consumption apparatus in the power house, are covered by two auxiliary transformers each of which is connected to its 18-kV busbar. In addition one auxiliary transformer is connected to the 40-kV switchgear, which supplies energy for the spillways, the workers' dwellings and the rural distribution.

Intake

From the wide headrace canal, short separated rock canals lead to each of the three intakes as well as to a fourth, which will be carried out later on. Each intake consists of a 164 ft long, unlined rock tunnel,

the opening of which is located entirely below the water level but otherwise has a free water surface. The gross area of the intake opening is 1830 sq ft, corresponding to a flow velocity of about 4 ft/sec with the utilized volume of water. Hydraulic-operated sector gates were installed and can be closed within 10 sec if necessary.

Penstocks

The vertical penstocks form a bend at their lower end where they pass into the spiral casing of the turbine. After a short intermediate section, the penstocks have a constant internal diameter of 26.25 ft over the vertical section. The diameter then decreases down to 21.33 ft at the point of transition to the spiral casing.

To arrange for the fourth unit that has been planned, a short part of the intake tunnel's upstream end has been blasted out; also, grooves and sills have been cast in position to provide for a shutoff with needle gates. The rest of the work can be carried out later from the entrance tunnel.

The penstock shafts are completely lined with concrete and they are covered with sheet steel from their lower end up to the roof level of the power house.

The power house is located in a cavern 400 ft long, 61 ft wide and

Special drill rig with 13 automatically guided drills used in world's largest tailrace tunnel.



STORNORRFORS

95 ft high. One end is occupied by the control department and the other by the unloading floor where space has also been reserved for the future fourth unit.

The techniques used to blast the roof surface of the generator and transformer rooms left the rock surfaces exceptionally smooth so that concrete linings were held to a minimum.

For the reinforcement of the roof a special method was used to anchor bolts that were inserted into holes which were drilled in the rock surface. A concrete-mortar mixture was forced into the holes before the bolts were driven in—rather than using conventional expansion anchors. This new anchoring method (known as the SN-method) was developed at Stornorrfor.

As soon as blasting of the entire cavern had been completed, the longitudinal walls, which are 56 ft high and about 12 in. thick, were placed by means of sliding forms. The walls at the unloading floor were placed in horizontal-form sections 46 ft long, about 19.5 ft wide and 1 ft thick. After speeding the hardening process with warm water, the walls were raised into position by means of winches.

The generator foundations rest on the turbine's fixed guide vanes and are sustained laterally by the floor framing placed previously on a level with the generator. The thrust bearing for the rotor and the rotating parts of the turbine are supported in the usual manner by a spider resting on the generator foundations and located directly beneath the rotor. In addition, the generator is provided at the top with a lateral support in the form of a smaller spider.

The lifting equipment in the generator room consists of two traveling cranes each having a lifting capacity of 120 tons. They can be coupled together and supplemented by two additional traveling cranes which increase the total lifting capacity to 475 tons, that is to say, somewhat more than the weight of a complete rotor (448 tons).

Connection with the ground level is provided by an entrance tunnel to the unloading floor and also by an elevator shaft. The entrance tun-

nel is 29.5 ft wide and 19.7 ft high, these dimensions being determined by the truck traffic during the building period and the fact that the transformers had to be transported over this route.

The elevator shaft which is 328 ft in depth has a concrete lining poured with a sliding form and stands clear of the rock. Apart from a passenger elevator, this shaft also includes a stairway. A small entrance building consisting chiefly of a reception room has been erected in connection with the elevator.

Transformer Room

The transformer room lies at approximately the same level and is parallel to the generator room. These rooms are connected to each other by three small tunnels, one of which is somewhat larger than the other two and contains pipe lines for the cooling water and ventilation.

The transformers can be moved on rails into the generator room through the access tunnel. With the help of the traveling cranes a transformer can then be lowered between two of the generators where space is available for transformer inspection and repair.

Practically all the walls and col-

umns in the transformer room were fabricated of precast concrete, and they were erected with a transportable crane.

Tailrace

The water flows from the individual draft tubes to a common tailrace tunnel 13,124 ft in length, which has been designed to handle the ultimate flow of the plant. The height of this tunnel is 87 ft and the maximum width is 52.5 ft. This tunnel has a far larger cross-sectional area than any other tailrace tunnel in the world.

The first section of the tunnel runs horizontally but owing to the position of rock-surface the second section had to be driven downward so that the lowest point lies almost 200 ft below sea level.

Timber Floating

As all timber floated down the river must pass the installation, very exacting demands are made on the timber floating arrangements. The ordinary floating channel consists of a flume the intake for which is upstream from the power station intake and runs about 3.5 miles to empty into the tailrace canal shortly above the point at which the latter flows into the river.

Assembly of stay-vane ring prior to welding. The ring was transported in four parts due to size.



The flume is made up of semi-circular elements and is designed for a capacity of 25,000 logs per hour with normal discharge. Logs can also be passed through the spillway during emergencies.

The actual construction of Stornorrfor began in 1953 with the first unit going into service October 1958, the second unit early in 1959 and third unit May 1959.

The amount of solid rock blasted from the tailrace tunnel amounted to about 2-million yds; from the headrace canal 0.85-million yds and the total excavated masses (almost 100 percent solid rock) was about 3.5-million yds. On the other hand only about 78,500 yds of concrete were required for the project.

Project Cost

The total cost for the installation was about \$41.2-million, divided as follows:

	Million Dollars
*Land acquisition	4.9
Building costs.....	26.2
Mechanical equipment.....	4.2
Electrical equipment.....	5.9

*Includes measures to prevent damage such as pumping that became necessary due to raising the pool level above the dam.

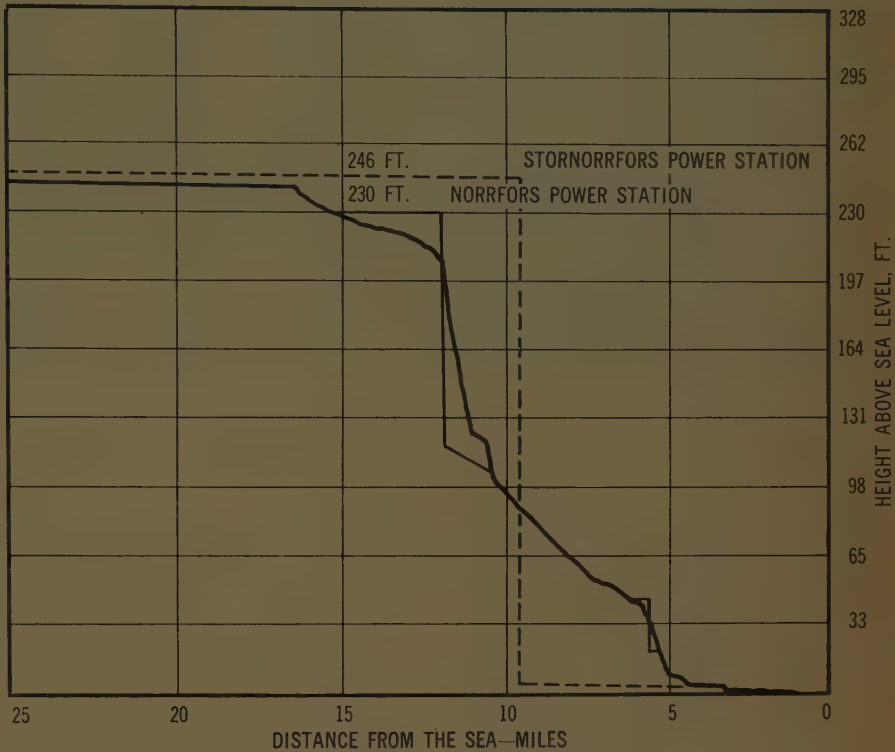
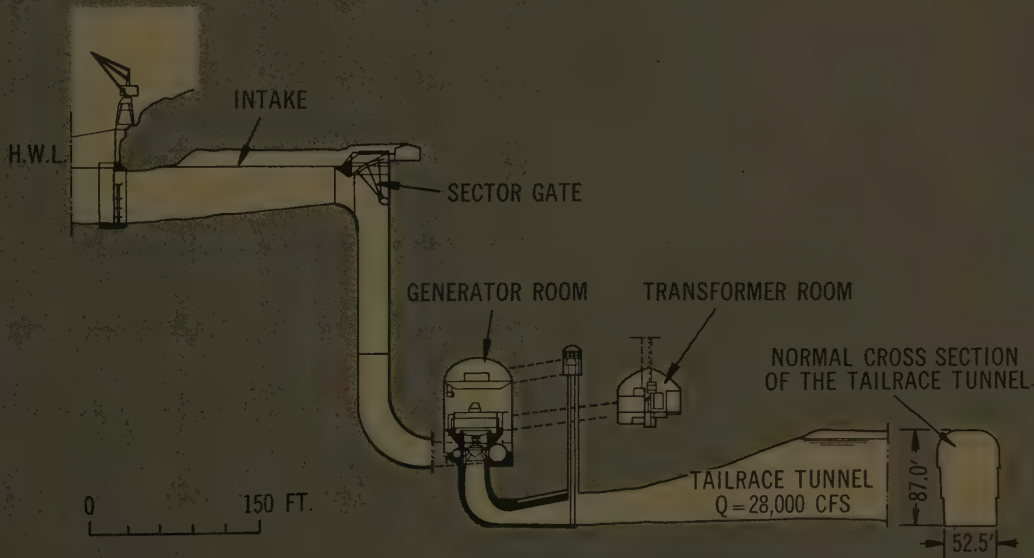


Fig. 1—Profile of the lower reaches of the Ume river.

Vertical section through the Stornorrfor power plant.





NAPA-PUBG Conferees Take a Hard Look:

Needs for New Dimensions in Ethics, Profits, R&D, Utility Purchasing Men Hear from Buyers, Sellers

What does the "Economic Challenge of Growth" hold in store for us in the next decade? Members of the Public Utility Buyers Group of the National Association of Purchasing Agents asked this key question of themselves and industry leaders who addressed their 30th annual mid-winter conference, held in Detroit last month.

The chairman of the NAPA Group, Commonwealth Edison's Robert B. Gear, acknowledged that the tremendous growth pattern established by the utility industry carries with it the responsibility that management techniques keep abreast of this rapid plant expansion.

"Particularly is this so in the field of purchasing and materials management," he conceded. "Will utility buyers be able to continue to hold the line on costs and even show further savings?" The need for closer supplier-buyer cooperation in equalizing production peaks and valleys, in reducing order lead-times and in materials warehousing require further discussion . . . as do such problems as equipment warranties . . . and ethical practices, Chairman Gear pointed out in inviting participation in the program.

The conference timing coincided, in a most ironic way, with the actions by the Federal Judge in Philadelphia, fining and sentencing most of the utility industry's major suppliers and many of the manufacturing sales executives who have served the utility field in recent years.

Marketing conditions, mutual considerations and problems, ethical practices—all figured prominently in the conference proceedings. And, a new sober seriousness marked the attention given to those who addressed this key meeting bringing together well over 600 of the people who figure most prominently in the buying and selling in this huge industry marketplace.

W. M. Wallace, vice-president of

Allis-Chalmers, placed new stress on the long-established "teamwork" function of the electrical industry. He warned against unwittingly helping to sell America short, urging that "we must make sure we, as the free peoples, stand united."

(Mr. Wallace replaced J. L. Singleton, executive vice-president of Allis-Chalmers, on the program, presenting "some of Mr. Singleton's thoughts, as well as some of my own.")

The Allis-Chalmers executive offered these views on supplier relations with the utility industry:

"The importance of the electrical industry to our economy and our way of life makes it doubly important that we, as an industry, stand together. How then, are we going to deal with the various elements which are threatening our nation and our economy in The Challenging Sixties?

"First, and foremost—we must be alert to those proponents of 'something for nothing.' This means that we have to realize once again how

our free economy—the most dynamic economy the world has ever known—came into being: It was the unbridled right of people investing their hard earned dollars in a business to expect a fair rate of return on their investment. We have called it the 'right to make a profit.'

"I question if some of us have been afraid to make a profit," said Mr. Wallace. "Can it be possible that responsible business men turn away from the call for leadership—from the call, yes, from the challenge, to provide the quality, performance, reliability, and service to which our customers are entitled and to sell those vital ingredients at prices which result in a profit? Can it be that responsible businessmen are so instilled or so imbued with the economics of volume that the interpretation and the awareness of the necessity of profit has been lost? Such an attitude and such a philosophy can make a most damaging and negative contribution to the health of our economy and the strength of our international position.

"Some of us have been 'afraid' to proclaim that profits not only are necessary to give investors a fair return on their investment—but that profits make plant expansions



Before one session of NAPA-PUBG conference begins, two speakers greet each other, with the session chairman, Basil L. Nelson, general supt. of purchasing for Northern States Power Co. in the center. At left is Allis-Chalmers V-P W. M. Wallace; at right is General Electric V-P Clarence H. Linder.

possible—that profits make it possible to provide more jobs for more people—that profit makes possible new and better manufacturing techniques and processes—and above all, that profit makes possible the research and development which is so necessary for us to survive—not only in our own highly competitive national economy—but also in the now very highly competitive world economy.

“I am sure you all know that much of the progress of the utilities has been tied directly to research and development carried on by the manufacturers. This research and development has been carried on only with dollars earned.

“Statements by various members of the electrical machinery industry indicate that, as a group, we are spending from 5- to 7-cents of our sales dollar on research and development. One of the major producers stated recently that it has one out of every 11 employees working in various stages of research, development and engineering. In my own Company we have one out of nine engaged in this type of work. As an example of what this amounts to in money annually, let's take the five largest electrical manufacturers. Their annual sales will total about \$7-billion. If the average spent by this group is 6-percent of the sales dollar, then the total annual investment in research and development would be \$420-million. That's the amount which is being spent by only five different companies—all fierce competitors. We do not believe that you want the manufacturers to curtail research and development. (In 1940 our nation as a whole, spent only \$350-million in R&D. The total rose to about \$3.5-billion in 1952 and will soar to an estimated \$13-billion in 1961.)

“From time to time we hear considerable discussion regarding the best way to conduct research and development in the electrical industry,” continued Mr. Wallace. “Some feel that perhaps a given amount of money should be pooled and spent under the combined direction of an industry group of even an agency of the Government. That certainly is one way of conducting a research program—but a dangerous one! It seems to us that pooled efforts would be far less effective than our



Chairmen of the Public Utility Buyers conference held in Detroit last month, together between sessions here, are (l. to r.): Frank E. Baxter, Pacific Gas & Elect. Co. (and new chairman); Basil L. Nelson, Northern States Power Co.; Robert B. Gear, Commonwealth Edison Co. (retiring chairman); and John M. Warner, Philadelphia Elect. Co.

present method of each company doing its own on a competitive basis. A single research agency program, by eliminating competition, would—undoubtedly—result in a slowing down of progress.”

Research is inseparable from manufacturing and engineering—they go together. That is why, in our Company, we have been able to vigorously maintain a continuous program to reduce cost through design improvements on existing or soon-to-be-available equipment, Mr. Wallace pointed out.

“We in the power business should constantly challenge the adequacy of our methods, our engineering and our developments. To make this challenge effective, it is necessary to have a sympathetic team made up of users of power apparatus and manufacturers of that apparatus—each member appreciating and respecting the problems of the other.

“The only weak links in the chain which will put us through the challenge ahead are the individuals who sell themselves, their colleagues and their country short. We cannot be influenced by negative thinking, nor must we refuse to assume the leadership that is so vitally needed on an individual and company basis to provide quality products and services at a fair price and at a profit.”

Mr. Wallace referred to an open letter written by Allis-Chalmers Pres. Robert Stevenson to top executives (and published in “The Wall Street Journal”), part of which he quoted:

“We believe you will agree that price is but one factor in determining the value of a particular piece of capital equipment. Without quality, long life, performance, reliability, service and application help, price is no measure at all.

“These measures of value vary from company to company. Differences in design, materials and workmanship give definite *plus factors* to some products. Although costly to include, these will be of *real value* to you and other customers.

“We urge you to buy your capital equipment on an evaluated basis. In fact, that is the only way important production apparatus should be bought.”

On this Mr. Wallace commented:

“There are many pressures brought to bear in the markets which we serve. These are the markets in which we must sell and sell profitably. You, in the electric power business, and we, in the electrical equipment business, must face up to the basic considerations of value *given* and value *received*. We in our company have re-dedicated ourselves to selling value and to selling value on a competitive basis,” he concluded.

Linder: “A Delicate Balance”

Speaking on “The Economics of Value,” Clarence H. Linder, vice-president of General Electric, developed his view of the “delicate balance” existing in this industrial market, where overemphasis of one

of numerous factors can upset all. Buying on price alone, cautioned Mr. Linder is "just such a pressure." Acknowledge the extra factors we put into our products, he asked.

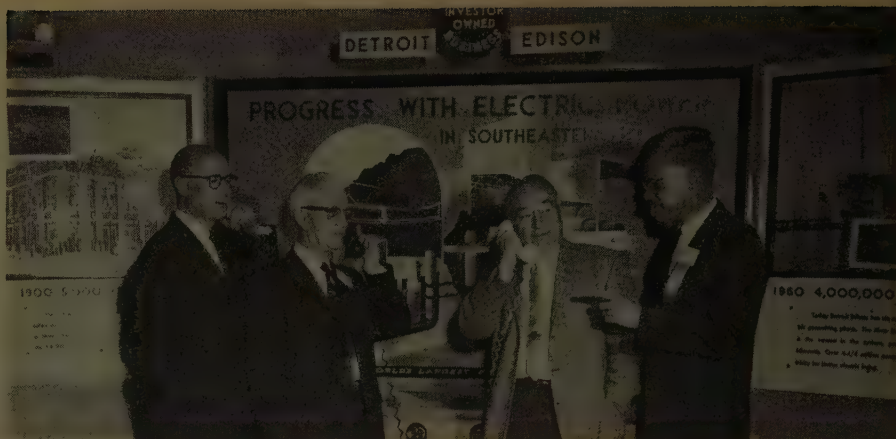
For the first time in its history, noted the GE executive, the utility industry is facing a rising trend in production costs. This makes it all the more important that utility buyers state their needs and wants more precisely—"in an optimum way, not more or less than is required."

Mr. Linder referred to his company's efforts in developing new programs for analyzing costs in productions on a long-term reduction basis.

Shew: "A Longer-Range View"

Warren W. Shew, publisher of "Electrical World," addressed the Group "as an unbiased bystander." Describing the customer-stockholder as "the fellow we are accountable to in the end," Mr. Shew based his remarks on the need to face current industry problems that are shared mutually by buyers and sellers. Referring to this single customer-stockholder, Mr. Shew said: "Up until now he has not been greatly interested in our intramural wrangling, but he may become more interested in the months ahead. And unless we can summon the wisdom to work out our own problems, the political representatives of that ultimate customer may very well decide to step in and take the problems and our business right out of our hands.

"We must bear the weight of mutual responsibility for the health of our industry as we look ahead at this 'New Era of Competition.' It is an era: (1) in which electric utility plant will be expanding at or very near the average rate that it has been expanding over the past decade; (2) which begins with low prices; (3) in which there is a considerable overcapacity of production on the part of manufacturers; (4) which begins with unrestricted competition in many product areas; (5) in which foreign suppliers, in combination or singly, are desperately trying to get a foothold in the domestic market; (6) in which government surveillance will be more with us than at any time since World War II; (7) in which we may



Host company for the NAPA-PUBG conference last month was the Detroit Edison Co. Chairman of the committee on local arrangements (at right) was that utility's W. J. Pierce. At left are Detroit Edison's Robert C. Bouse, banquet committee chairman, and Harold McDonald, chairman of the registration and printing committee. Between McDonald and Pierce is A. E. McKinley of Wagner Elect. Co.

see some retreat from the strict decentralization program of some of the larger suppliers; (8) in which the continued regrouping of manufacturers may be anticipated; (9) in which the utility will have to compete more directly with defense and consumer purchasers for the attention of suppliers; (10) when research and development takes on new significance for the buyer, and yet an era in which R&D spending may have to be trimmed; and, (11) in which the so-called 'turn-key contract' is just making its appearance over the horizon—a development that could be of tremendous significance to this whole 'New Era of Competition.'"

In the new era coming, said Mr. Shew, perhaps we will get rid of some apparent fat and unnecessary frills that will make manufacturers more efficient. But, noted Mr. Shew, this works both ways "and electric utilities will be called on to look into their operations and do likewise."

Added Mr. Shew: "You are deeply involved in manufacturers' welfare. For nearly every one of your product needs, utilities represent almost the entire market. The percentage of meters, transformers, power circuit breakers, cutout, switchgear, etc., that is not bought by utilities is frequently but a fraction of one percent of the total output. Regardless of the price you pay, you will not buy one more device than your engineering and operating needs.

"This means that you control the destinies of most manufacturers.

You must realize this, be familiar with the makeup of the entire group of suppliers for a given product line and set policies for the health of that segment of the industry."

Urging his buyer-supplier audience to "take a longer-range point of view in your own self-interest," Mr. Shew concluded by making some specific suggestions for alleviating some of their mutual problems. (These are listed in accompanying columns.)

Rockwell: "Government Role Complex"

Col. Willard F. Rockwell, board chairman of the Rockwell Mfg. Co., also devoted much of his message to the conditions surrounding alleged price-fixing practices in industry. He observed that price-fixing in this country is not only permitted in some private lines, but prices are fixed by the government itself in other private business lines, with heavy penalties for violations; while price-fixing without government permission subjects private business to fines, plus triple damages.

Col. Rockwell noted the complex situation industry faces in coping with government intervention:

"It can truly be said that our government does not let the right hand know what it is doing to the left hand. Outside of agriculture, no businessman and no corporation can find a guide through the fields of business which are planted with land mines by the Federal Trade Commission and the U. S. Department of Justice."

Col. Rockwell then recalled how Adam Smith, author of "The Wealth of Nations," ("written before our nation was born and when the industrial revolution as immature as present-day progress in interplanetary travel") displayed a knowledge of industrial economic facts and related human reactions which has never been equalled. Said Col. Rockwell:

"He (Adam Smith) accurately described what went on then, what is going on today, and will go on as long as human beings are engaged in business and commerce." He said, "People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices. It is impossible indeed to prevent such meetings, by any law which either could be executed, or would be consistent with liberty and justice. But though the law cannot hinder people of the same trade from sometimes assembling together, it ought to do nothing to facilitate such assemblies; much less render them necessary."

Col. Rockwell commented further about competitive enterprise:

"Any manufacturer who has not tried to build his products so much better and cheaper than his competitor for the purpose of monopolizing the market for his products, is not working for the best interests of his investors, his employees, and his actual and potential customers. If he does not make a profit we can agree with Samuel Gompers, who said, in effect, that there is nothing worse for the economy than a business which operates at a loss—and he was speaking particularly for the working man.

"Big profits in any enterprise or line of industry encourage competition—and who can remember any very profitable enterprise which was able to continue its monopoly for any long period without constantly lowering its costs and simultaneously lowering its prices so as to expand its markets." He added: "The growth of every business is limited by the economic law of Supply and Demand, and every attempt to increase the percentage of profit above a reasonable level has been defeated by the immutable eco-

Marketing to the Utility Industry: Buyers, Sellers Face Mutual Problems

Here Are Suggestions for Alleviating Them—

FOR SUPPLIERS—

1. Don't take advantage of location to push for reciprocal buying. There is no surer way of losing the respect of your customer.
2. Don't discriminate in pricing your products to utility customers. With top management now keeping an eye on even piddling orders, you only stand to embarrass your best friends—the purchasing people. Information on your quotation to other utility customers often travel faster than you do. It is time to stop responding to the designation of "hard" and "soft" buyers.
3. Set prices and hold to them until the market gets a chance to know about it.
4. Speak more frankly of your pricing policies to your customers. I believe that part of the reason for present chaotic marketing conditions is that you have insisted on keeping an aura of mystery about your pricing practices and your pricing policies. Stripped as they are now, your policies have lost their mystery and seem to be no more than a slavish following of market-generated prices.
5. Get over the idea that there will ever be a seller's market. Without unforeseen and unforeseeable circumstances, the problems of excess production capacity will be with you from now on. This is the new era of competition. Accept it and stop looking ahead for that bright, bright day of the great pay-off.
6. Explore new ways of serving your customers. Some suppliers are finding real savings that can

be passed along to buyers outside the pale of mundane price-cutting.

7. Offer the utility buyers some incentive for smooth out cyclical and seasonal buying curves.
8. Allocate a fair share of R&D costs to the basic cost of a product.
9. Sell the extra quality in your product. Don't trim the quality just so you can meet somebody else's price.

(Offered by Warren W. Shew, publisher of "Electrical World")

FOR BUYERS—

1. **Deal fairly**—Avoid favoritism and make each transaction both a good buy for the company and a satisfactory deal for the seller.
2. **Do not bargain with suppliers**—get each bidder's best price on his first quotation on a particular purchase or to meet a competitive bid.
3. **Keep prices confidential**—do not tell a vendor what prices are being quoted by his competitors.
4. **Establish good personal relationships with salesmen**—this can be better accomplished when incidental social expenses are shared equally by buyer and seller.
5. **Know each product you buy**—increase your knowledge of materials and manufacturing processes.
6. **Cooperate freely with other departments**—and be receptive to counsel from them.
7. **Promote good will**—make purchasing a real service function in all your dealing.

(Offered by C. F. Ogden, vice president of Detroit Edison Co.)

nomic law of Diminishing Returns."

Moss: "Review Your Policy"

Louis H. Moss, purchasing agent of New Orleans P. S. Inc., urged his colleagues in utility purchasing, on return to their offices, to review their corporate policies relative to "ethics in purchasing." Your own company policy "is what it is due to reasons best known to your management," he suggested.

Mr. Moss noted that the buyer of any company must face numerous ethical problems in carrying out his daily functions. Unless he is ever alert to the responsibilities entrusted to him by his management he may find himself unwittingly doing certain acts that may be considered unethical, said Mr. Moss.

"His prime responsibility is, of course, to his own company. He
(Continued on page 81)

Better Equipment, Lower Insurance Rates, Result Of Testing, Doble Clients Hear

Nearly 350 engineers from almost every state and from several foreign countries participated in the 28th annual Doble Client Conference held in Boston during the last full week of January. Especially evident during the meeting was the rapid growth in acceptance of testing procedures not only for checking out new equipment but for guidance in preventive maintenance. Noticeable, too, were advancements and refinements of many test methods to produce more precise indications of impending trouble.

In the initial technical discussion, following a day of reviewing maintenance testing, W. W. Thompson, TVA, reported effective use of silicone grease to prevent surface leakage and flashover of porcelain insulators in high contamination areas. Life of the material is related to thickness of coating, he said, and spray-gun application shows some promise although it is costly. A cheaper grease with proper viscosity and encapsulating qualities would greatly encourage more general use of the method, he concluded.

Test data indicating consistently low power factor on post-type insulators having internal walls treated with silicone were presented by Charles Corey, Lapp Insulator Co., Inc. The treatment, he said, provides insurance against the possibility of a defective plug in a unit causing difficulty in the field.

Future progress in capacitor

switching seems to point to wider use of reactors to limit inrush currents and allow use of larger banks, L. M. Partridge, Public Service Company of New Hampshire, told conferees. Also, he predicted a more general application of vacuum switches for switching functions at higher voltages. Subsequent discussion, noting failure of some reactors due to high oscillatory voltage across the reactor, resolved that a special reactor designed specifically for capacitor switching must be used. One conferee reported excellent results with load-break switches of the flipper type for capacitor switching.

The trend in ungrounded specimen power factor readings provides a dependable indication of bushing quality, according to D. L. Johnston, General Electric Company, and this method of evaluation is recommended for TBI bushings, he said. When certain conditions of leakage upset the normal trend of readings, he suggested, in most cases irregularities can be dispelled by cleaning porcelain and remeasuring; in other cases it may be necessary to obtain inverted grounded and ungrounded specimen readings in order to know the whole story.

A practical company-made three-wheel cart equipped with a hydraulic lift for removing and replacing large OCB bushings was described by O. A. Browne, Western Mass. Electric Co. Mechanical and electrical hazards posed by

space limitations in substations dictated design of the specialized equipment, he said, and ruled out use of existing trucks equipped with derricks.

Switchgear

Messrs. MacDonald, Alexander, and Brown, Indianapolis Power & Light Company, collaborated in a presentation describing a program of corona detection in 13.2-kv metalclad switchgear sets in order to establish maintenance schedules and specification standards for new corona-free switchgear, and to reduce frequency of visual inspections. Most useful results, according to the authors, were obtained by energizing equipment at or above rated voltage with a corona-free transformer and using a coupling network to isolate radio noise produced by corona discharge. This information was fed to a metering circuit for quantitative measurement and to an oscilloscope for identification of type and frequency of discharge.

Cable

Outlook for resin splicing of 15- to 27-kv cable is optimistic, according to E. W. Bollmeier, Minnesota Mining and Mfg. Co. A substantial amount of laboratory evidence indicates that 15-kv resin splices can equal or exceed electrical properties and life of the cable, he said.

In a review of factory and field testing of cable, E. E. McIlveen, Okonite Company, noted several advantages of high voltage d-c cable testing over a-c testing. Higher voltages can be applied, he said, because d-c has no damaging effect on a sound dielectric during the duration of the test. D-c testing more readily picks out local defects and mechanical damage, frequently foretells impending breakdown through leakage current, and d-c test equipment for testing long cable lengths is much smaller, he observed.

Rotating Machinery

Messrs. Chandler and Duke, TVA, reported a successful method of locating broken squirrel-cage rotor bars, first using the single-phase induction voltage test to verify presence of a break and then, when the rotor is accessible,

Chairmaning insulator session of Doble conference is L. M. Partridge, left, P. S. of New Hampshire; with him are O. R. Compton, Va. Electric & Power, vice chairman; H. A. Walsh, conference program coordinator, and G. W. Armstrong, committee secretary, both of Doble Engineering.



Inspecting Doble test equipment during conference recess are, from left: P. W. Robertson, British Columbia Power Commission; G. H. King, West Texas Utilities; and H. J. Winsor, City of Tacoma.



applying the conventional growler test to induce current in the bars. This sets up a magnetic field which attracts a magnetic probe to all but the broken bars which carry no current and, hence, have no magnetic field.

Consensus of panel members participating in a symposium on testing and maintenance of rotating machinery favored pulling rotors after the first year, then every five years unless visual inspection indicates poor condition. While some recommended more frequent scheduling of maintenance outages, they admitted that service demands did not always make this possible. Noteworthy among both panel members and spokesmen from the floor was the apparent widespread acceptance of testing procedures which were almost non-existent 10 years ago. Several panel members and others reported making high-voltage d-c tests, corona tests, and power factor tests on a regular scheduled basis.

Panel members were in complete agreement with regard to the urgency of taking every possible safety precaution during tests. Step by step procedures in isolating, grounding, and testing equipment should be reviewed with the safety department, it was suggested. In addition, all electrical connections and switches should be tagged, warning signs should be located in strategic spots, and test areas should be roped off, they agreed.

Different test values should be used when testing units under low hydrogen pressure, according to L. A. Kenoyer, U. S. Army Corps of Engineers. Testing in hydrogen will sometimes reveal ionization, he said,

when there is no indication of trouble while testing in air.

Power Transformers

Mr. Kenoyer also reported excellent results with vacuum filling of power transformers using a vapor trap and small pump mounted on top of the transformer. Most air and some water is removed by vacuum filling when the oil is sprayed in, he said. He suggested using a short rigid pipe rather than flexible tubing for applying the vacuum.

Collapsible rubber storage containers for storing insulating oils should be used with caution, according to T. A. Pinkham, Doble Engineering Company. As a result of preliminary laboratory tests, he said, evidence indicates that use of these containers for periodic temporary storage could lead to definite deterioration of the container and also to undesirable contamination of the oil. Containers cannot reason-

ably be cleaned between uses, he suggested, and unless a new coating is developed that is unaffected by and does not affect oil, use should perhaps be limited to transporting oil rather than storing it.

Comparing U. S. and foreign practices in power transformer design, P. L. Bellaschi, Doble Engineering Company, said that although foreign transformers are built to American standards, relatively higher failure incidence may be ascribed to new design, lack of experience in high ratings, failure to keep up with insulation developments and, in some instances, long distance shipping. Foreign manufacturers have been slow to go to solid insulations, he said, although some of their design features are unique; for example, one manufacturer has placed low-voltage bushings at the top and high-voltage bushings at the bottom, saving some three feet in height.

Commenting on domestic design, Mr. Bellaschi noted that core form units have a somewhat better performance record than shell form but shipping is a problem in the larger classes. Performance records of shell units have shown improvement, he added, and, with but one exception, shell form units in Europe have been very successful.

The first production model of a fault gas detector for field use was introduced by H. H. Wagner, Pennsylvania Transformer Div., McGraw-Edison Co. The unit measures combustible gas, indicating when corrective maintenance or removal of a transformer from service are necessary.

A suggestion that transformer

Circuit breaker and bushing session of Doble conference is chairmanned by R. E. O'Leary, left, Ohio Power Co.; committee secretary is S. H. Osborn, Jr., Doble; vice chairman is W. W. Thompson, Tennessee Valley Authority.





This cutaway scale model shows the tippie construction of our new cleaning plant operation. It is now under construction at our Federal No. 1 mine at Grant Town, West Virginia.

WE ARE BUILDING A NEW CLEANING PLANT

**... better, cleaner coal will come
from this Eastern Gas and Fuel
12,500 tons-per-day new facility**

With the completion of the new processing plant at Federal No. 1 mine, we will have the most modern facilities in the Fairmont, West Virginia, coal field. Designed to handle 825 tons-per-hour of raw coal, the new cleaning plant will produce 12,500 tons-per-day of completely cleaned, dried coal in a wide range of sizes.

The plant will be equipped with the most modern machinery for cleaning and sizing the coal. Deister tables, froth cell units and heavy media separation will be used to purify the coal, and several types of dryers and dewatering equipment provide a low moisture content finished product.

Most of the processes within the plant are automatic, including sampling of each size of coal, which provides excellent quality control.

This addition to our facilities reaffirms our faith in the future of coal and our determination to continually improve our product. It underscores, too, a recognition of customer's needs and the ever expanding demand for quality coal. The new plant is now under construction, and is expected to be in full operation in early 1962.

Any Eastern representative will be glad to explain in detail how this new plant can be of service to you. Offices located in Pittsburgh, Boston, Cleveland, Detroit, New York, Norfolk, Philadelphia and Syracuse.



EASTERN GAS AND FUEL ASSOCIATES





Heading up transformer discussions at the Doble conference are, from left: G. W. Early, Metropolitan Edison, chairman; R. E. Clark, Doble Engineering, secretary; and G. C. Pugh, West Penn Power, vice chairman.

Conferees attend Doble conference from near and far; here are, from left: S. H. Bouchev, Potomac Edison; V. Rapex, C. A. La Ec. De Caracas, Venezuela; and Sergio Guerrero, Com. Fed. de Electricidad, Mexico.



manufacturers provide users with results of factory power factor tests met with general approval of conferees; one recommended putting

the PF test record on the nameplate.

In the symposium on liquid insulations, a mild controversy developed over the pros and cons of hav-

ing a higher flash-point oil than the present standard for 55-C rise. Main concerns seemed to be whether or not the new 65-C rise oil, now standard in Westinghouse equipment to match new insulation levels, is compatible with the present 55-C oil and the insulation systems of 55-C equipment, whether or not users would have to store two types of oil, and what effect the increased viscosity of the higher flash point oil would have on its value as an insulation and on operation of hydraulic timers of reclosers.

Conferees were assured that the 65-C oil (145-C flash point) is compatible with the present oil and the equipment in which it is used. Viscosity has increased very little, they were told, and it is well below established limits; all other electrical, chemical, and physical properties were said to be virtually identical.

One conferee pointed out that present standard ASA oils range from 130 to 148-C and that there is no noticeable degradation to 175-C. He recommended retaining the present standard but attempting to get suppliers of oil in the 130-C range to set their sights on 140-C. One supplier expressed a watch and wait attitude in preference to supplying two types of oil. Tenor of discussions seemed to indicate that storing two types of oil would not be popular but that higher flash point than the present 130-C minimum would be desirable to improve safety margin when overloading during peaks.

EEI T&D Meeting Explores Storm Resisting, CSP Vs Conventional, and Cable Ratings

A diversified program was presented at the EEI Transmission and Distribution Committee meeting held in Philadelphia, January 18-20. It was attended by 250 members and guests.

In describing Public Service Electric and Gas Company's "New Look" storm resistant overhead distribution plant, G. A. Ewald said that the primary damage rate by hurricane "Donna" to the old-standard construction was about $5\frac{1}{2}$ times the rate for the new-standard construction. This ratio is not a true comparison of the effect of storm

damage on the two types of construction because so much of the new standard construction was installed in heavily-treed areas which are the most vulnerable portions of the service area, he asserted. The major innovations in the new construction were: elimination of series street lighting wire on distribution pole crossarms and conversion to multiple installations; use of insulated high strength 4-kv single phase primaries and factory-lashed aerial cable or spacer cable for three-phase primaries. The increased cost of this new standard

construction is only about $3\frac{1}{2}$ percent, Ewald stated.

Aluminum Towers

The real advantage of aluminum as a structural material for transmission towers lies in the possibility of a departure from the old standards of angles, channels, I-beams, etc., in the opinion of H. D. Fischer, Jr., Southern California Edison Co. With a little imagination plus a nominal investment in a die, almost any shape can be extruded in aluminum, he said. The ultimate in

aluminum tower design will not be achieved until the design of the most efficient member cross-sections becomes an integral part of the design of the tower per se, Fischer contended.

John M. Maples, Reynolds Metals Co., said that the aluminum tube shape is the most economical. In spite of a 50 percent greater cost per pound than that of other shapes, the weight differential lowers the cost of tube shape aluminum to about 65 percent of the cost of other shapes, he estimated.

Tower Load Relief Device

A transmission tower load relief device, developed by Baltimore Gas & Electric Co., was described by F. Link. It is corrosion resistant, has been thoroughly tested by his Company and will do a good job, he said. If favorable results are obtained by an independent evaluation now in process, these devices will be installed in all locations where tower failure would cause serious service interruptions, Link declared.

CSP Vs Conventional

The Wisconsin Electric Power Co. prefers conventional type distribution transformers, reported W. E. Kremmel for W. S. Wilder, in a discussion of CSP versus conventional distribution transformers. This preference is justified on four points: cost, compatibility, record of performance and safety, he said.

R. G. Steiner, Union Electric Co., in presenting the case for the CSP transformers, said that his Company has approximately 60,000 CSP's of a total plant of 75,000 single-phase distribution transformers. Based on total installations during the past three years, the average savings in initial in-place cost is approximately \$28.30 per CSP transformer, he estimated. Taxes, interest, and depreciation costs—also costs to maintain service are less for the CSP. Annual burnout rate for conventional units have been six times as great over the years, Steiner emphasized. Increased breaker setting has made it possible to more fully utilize the overload capability of the CSP and the emergency overload control makes it possible to restore service immediately after the breaker has tripped, he added.

Five years experience with 5 and 10-kva modified CSP transformers has shown their performance to be fully satisfactory compared to that of CSP and conventional transformers, reported E. N. Dye, West Penn Power Co. The modified CSP offers advantages in both installation and cost over conventional transformers and it realized annual savings in 1959 over CSP's of \$13,536 for 5-kva units and \$19,371 for 10-kva units, he said. Because of its good experience with modified CSP's in the 5 and 10-kva, 7200-v ratings since 1954, West Penn initiated their use for the 15-kva, 7200-v ratings in September 1960, Dye declared.

Loss Ratio

The 2/1 loss ratio transformers are economical if loaded to 125-190 percent of nameplate rating. This was reported by W. H. Johnson and W. E. Mekolites, American Electric

Power Service Corp. Average savings per transformer (based on 25-kva unit) will be \$1.20 per year over 3/1 ratio transformers loaded in their economical range for an annual load growth rate of 3 percent, they said. The 2/1 loss ratio transformer should be made a universal standard for all sizes and cost reductions must be made to permit elimination of the 15, 37½, and 75-kva sizes, they stressed.

240/480-Volt Distribution

A. A. Smith, Baltimore Gas & Electric Co., described a 240/480-v single phase underground distribution system installed in a total-electric home development near Annapolis. In view of the satisfactory experience at this development, the Company is convinced that the 240/480-v system has a definite application in supplying high demand residential loads and will offer this



CSP vs conventional distribution transformers discussion panel answers questions from floor—left to right are moderator H. R. McNutt, West Penn Power; C. K. Poarch, EEI Staff and Secretary of T&D Committee; R. G. Steiner, Union Electric, W. E. Kremmel, Wisconsin Electric Power; and E. N. Dye, West Penn Power.

EEI T&D Committee Chairman with various subcommittee chairmen and secretary—left to right are J. F. Hennessy, Baltimore Gas & Electric, Underground Subcommittee chairman; H. G. Hally, Iowa Power & Light, Standards & Specifications Subcommittee chairman; H. E. Cody, Cleveland Electric Illuminating, T&D Committee chairman; H. R. McNutt, West Penn Power, General Engineering Subcommittee chairman; and J. Lummis, Southern California Edison, Overhead Subcommittee chairman.



voltage to interested developers on its standard differential basis, Smith said. All cables are direct burial type with neoprene jackets: secondary mains are 250 or 500 MCM copper and individual services are No. 4 copper. The developer provided the trenching, conduits and transformer pads. Costs for this work favored the higher voltage system—\$220 per customer for 240/480-v compared with \$230 for 120/240-v, Smith stated.

Network Protectors

R. G. Atkinson, Public Service of Colorado, described a unique installation at United Airlines in which network protectors were adapted to serve critical load simultaneously from two sources of generation. He said that this system may also have possible application as an improvement over conventional underground network systems which may be served from two or more substations. With the use of network feeders from different substations within the same lateral duct line, a total outage on any one of the substations or feeder mains would have little or no effect on the network service voltage, Atkinson declared.

Standard Cable Ratings

By using standard cable ratings, Philadelphia Electric Co. avoids the confusion that would result if specific calculations were made to determine the rating of each installation, according to C. R. North. These standard ratings have aided designers, system planners and system operators by providing an orderly plan for utilizing the investment in cables, he asserted. Ratings must be low enough to prevent excessive damage from overloads and high enough to utilize the investment in cable plant at near its practical capacity. A high degree of utilization avoids the installation of costly additional capacity before it is actually needed, North declared.

Network Operations

D. F. Tulloch, Boston Edison, in reporting on the findings of an a-c network operations survey among 65 utilities, said there was a definite trend to the use of non-leaded cable. Fifty-two percent of the cable miles

in use from 1956-58 was non-leaded, he said. This was due almost entirely to the increased use of rubber-insulated neoprene-jacketed cable, which is reported to have an extremely low failure rate (.35 failures per 100 miles per year), Tulloch declared.

Screw Type Anchors

According to Ray Martin, A. B. Chance Co., there will be many applications for screw type foundation anchors in supporting utilities larger structures and equipment. An ideal application of their ability to support and resist uplift at the same time is for transmission tower footings, he asserted. They would allow the tower or structure to be erected without the time and expense in-

volved in making large excavations, pouring concrete and waiting for the concrete to cure, Martin added.

Galloping Conductor Research

In delivering the report on the MIT Galloping Conductor or Research Projector submitted by its Steering Committee, G. A. Ewald, Public Service Electric & Gas Co., said that experiments made on an actual 345-kv transmission line confirms the theoretical predictions of the generalized equations with respect to galloping characteristics. Based on wind tunnel and theoretical work, a vibration damper has been proposed which would limit the amplitude of galloping by absorbing energy from the line in a friction brake, he asserted.

NSP Returns To Envelope Billing

(Continued from page 51)

industry which will make our services more valuable and useful to you. In the end this will result in increased volume and lower costs of doing business, which will more than offset the immediate apparent increase in mailing expense."

Subjects And Make-up Differ

After the conversion to a standard billing basis is complete throughout NSP's service area — in other words, when all billing is being handled by the computer — the same insert will be sent to all customers each month. NSP plans to mail about six inserts per year, three containing sales-promotion advertising and three public-relations material. The insert schedule for 1961 looks like this:

- January — Supplementary electric heating
- February
- March — Taxes
- April
- May — Summer climate comfort
- June
- July — Count your appliances

- August
- September — Home lighting
- October
- November — Increasing efficiency
- December

The schedule shows that NSP plans to mail inserts with bills every other month during 1961, which will provide more time for origination of fresh ideas and presentations and, it is hoped, promote greater readership of the inserts. The inserts themselves will not follow a standard format, because NSP believes customers will be more likely to read them if they are different in color and shape each time.

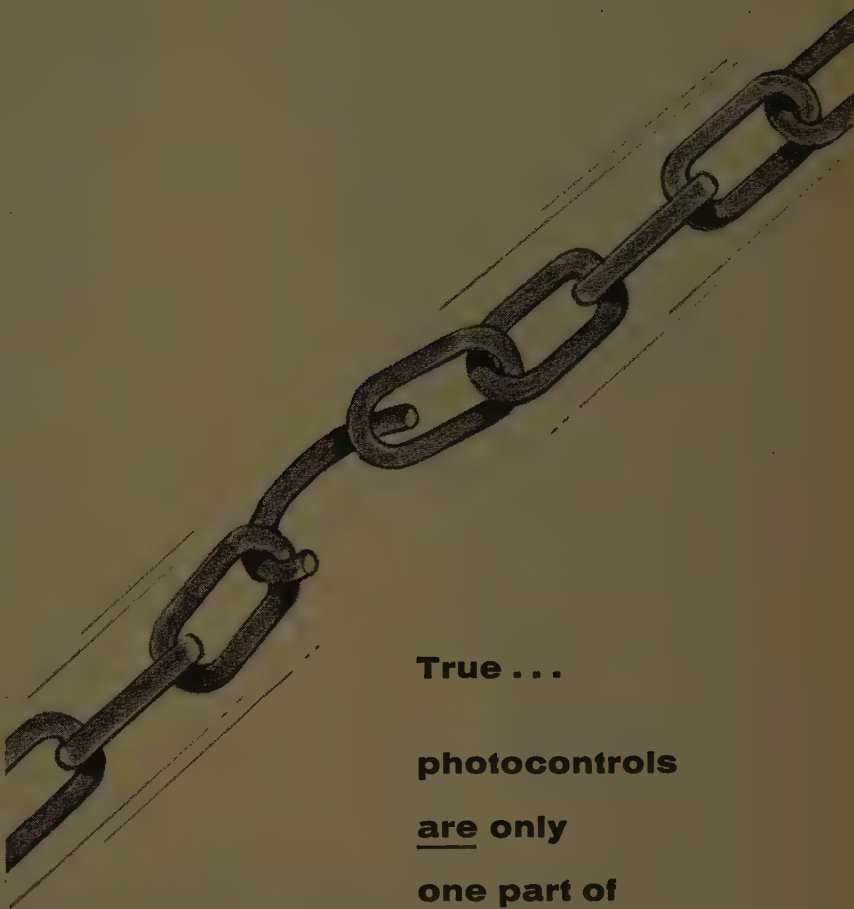
Northern States Power Company does not plan to decrease any of its newspaper, radio or television advertising because of the bill insert program. Rather, the Company is using this program as an additional means of selling electricity and gas and explaining various tax and industry problems, as well as another outlet for information promoting greater customer appreciation of what they are getting for their money from NSP.

should endeavor to obtain the most value for the dollar that he is authorized to spend. He must constantly study materials, stay abreast of the market conditions, develop dependable sources of supply, for the present and the future, and set a standard of ethical behavior in all these transactions that is consistent with the established company policy. He should, wherever possible, try to help cultivate this same sound ethical behavior among personnel in his company.

"The buyer also has very important obligations to his suppliers. He must at all times be fair in his dealings with his suppliers. He must never resort to sharp practices—the benefits that he may derive in this manner are short-lived and usually backfire in the long run. He must treat all quotations in a confidential manner—never revealing prices to a supplier's competitor, permit only one quotation from each supplier and be certain that each quotation is received by a specified date and time. The buyer should buy without prejudice and promote honesty and truth in buying and selling.

"Review your policy and see if there should be any changes made," the New Orleans utility representative urged. "See if your buyers are carrying out your company policy, and devote more of your time to this important phase of your job. The image that the public has of your company is not formed only by the excellent service that your company renders, but also by the way their business transactions are conducted. You as the purchasing agent can play a very important part in forming this image by the proper ethical behavior in the thousands of business dealings that you transact each year," Mr. Moss concluded.

(Editor's Note—Remarks by Mr. Moss were made in a panel discussion in the NAPA-PUBG conference. The session also covered purchasing practices such as invoice record keeping, vendor stocking of materials, small orders and steel versus aluminum. A report on this panel discussion will appear in EL&P for April 1.)



True . . .

**photocontrols
are only
one part of
your system**

. . . but they may be the *one* part that decides everything. All it takes to keep an otherwise perfectly good street lighting system in the dark (and someone on the carpet) is an "inexpensive", untried photocontrol someone has slapped together just so it would "sell". The worst of it is these "bargains" may work fine for a year or so, and then . . .

How are you fixed for links? Fisher-Pierce Division, Sigma Instruments, Inc., 81 Pearl St., So. Braintree 85, Mass.



FISHER PIERCE

**Electrical and Electronic Equipment
for Industry, Utilities and the Home**

BURROUGHS CORPORATION ANNOUNCES THE B 5000, WHICH SETS NEW STANDARDS

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$$\sum_{n=0}^{\infty} \int_0^{\infty} p(n, \lambda) L(\lambda) t^n d\lambda$$

$$a_{\psi,2} = \frac{\sqrt{e/m} E_0^{1/2}}{f^2} \frac{\partial}{\partial x} [\Phi'(\omega) V_0] + \frac{\partial}{\partial y} [\Phi'(\omega) V_0] - \frac{\partial}{\partial z} [\Phi'(\omega) V_0]$$



Jaybird Powerhouse and Camino Dam, recently completed as part of Sacramento Municipal Utility District's Upper American River Power Project. Engineering design and construction supervision by Bechtel; powerhouse and penstock construction by Pacific Bridge, dam by Gibbons and Reed.

Bechtel Experience at Work:

HYDRO

Direct experience with hydroelectric and water projects covers more than a third of a century, including a major role in the construction of Hoover Dam by Six Companies Inc.

Projects designed in the past several years have a constructed value of \$400 million. Nearly two million kilowatts is presently under design for future construction.

Bechtel also provides every required service under single responsibility in steam and nuclear power.

BECHTEL CORPORATION

Engineers and Builders for Industry

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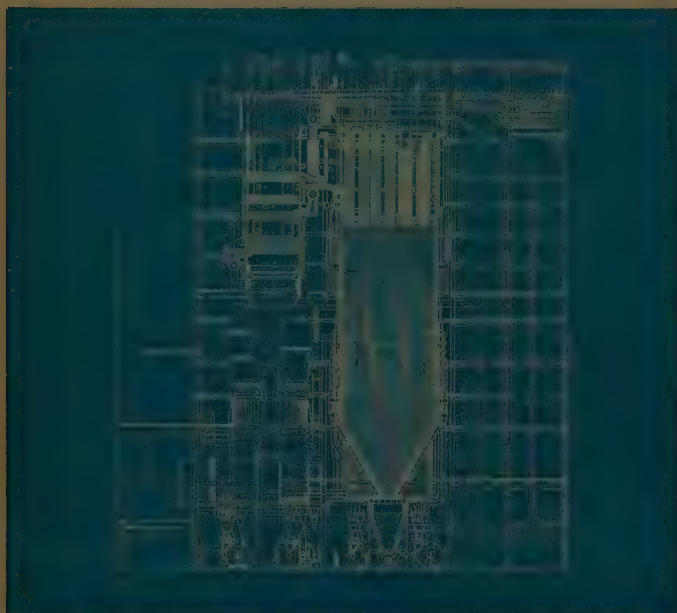
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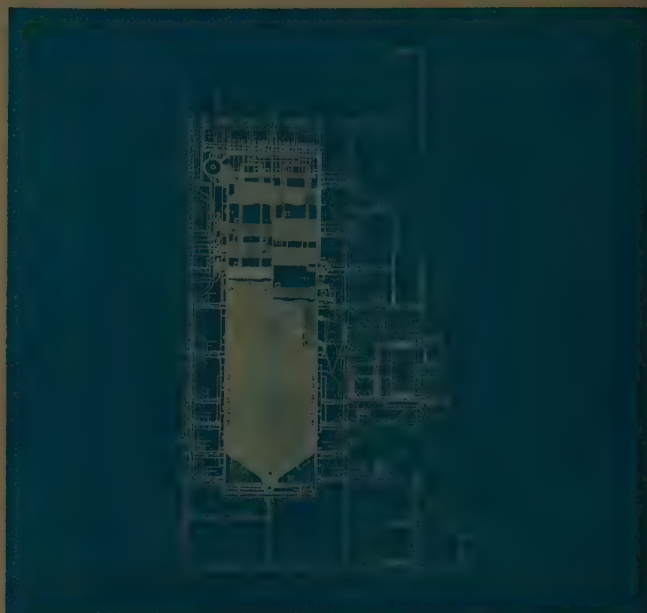


COMBUSTION'S ANNUAL

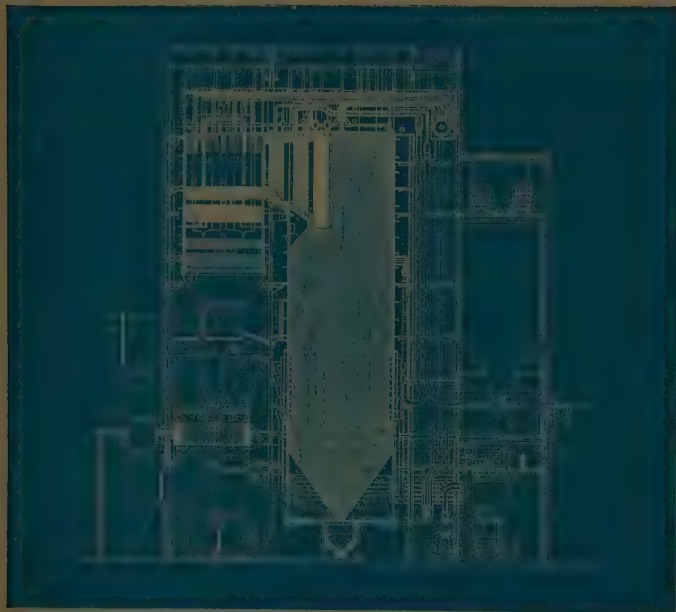
A REPRESENTATIVE CROSS SECTION OF 1960 C-E INSTALLATIONS



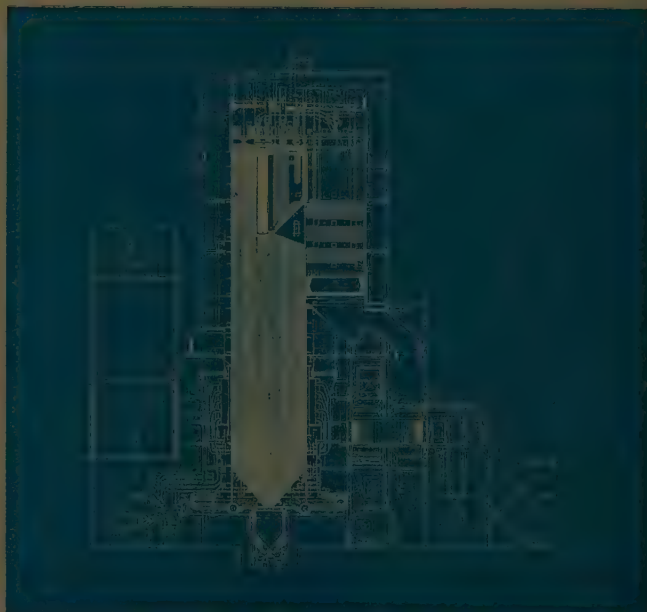
This pulverized coal fired C-E Sulzer Monotube Steam Generator went into service in 1960, at the Eddystone Station of Philadelphia Electric Company. The 325-mw unit is designed to provide steam at 5000 psi with superheat and reheat temperatures of 1200F/1050F/1050F.



This 110-mw unit went into operation at the Ocotillo Steam Electric Station of Arizona Public Service Company. It is a C-E radiant reheat boiler, fired by natural gas and oil, and produces steam at 1925 psi. Superheat and reheat temperatures are 1005F/1005F.



A 500-mw unit was placed in service at the Widows Creek Station of the Tennessee Valley Authority in 1960. It is a C-E Controlled Circulation, radiant reheat boiler, pulverized coal fired, producing steam at 2450 psi. Superheat and reheat temperatures are 1053F/1003F.



This C-E Controlled Circulation, radiant reheat boiler was placed in service at Montrose Steam Electric Station of Kansas City Power & Light Company in 1960. The 156-mw unit, fired by pulverized coal, produces steam at 1925 psi. with superheat and reheat temperatures of 1005F/1005F.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

STATISTICAL REPORT

In 1960, the electric utility industry placed in service about 10,800 megawatts of new thermal generating capacity.* C-E's contribution to this total was 4,678 megawatts and included two noteworthy firsts. One, a C-E Controlled Circulation unit is the world's first boiler to serve a 500 megawatt turbine-generator. The other represents the most advanced power plant cycle yet attempted. It is a C-E Sulzer Monotube Steam Generator designed to deliver 1200F steam at a pressure of 5000 psi to a 325 megawatt turbine-generator.

*Source: "Electrical World"

Both of these units were placed in commercial operation in 1960.

During the year, the electric utility industry ordered approximately 3,700 megawatts of new boiler capacity from C-E. Over 80% of this total is to be served by C-E Controlled Circulation Boilers. More than 60% of the total capacity ordered is for turbine throttle operation of 2400 psi and above. C-E's 1960 order board shows a total of 5 units with capacities of 300 mw and above, including one 500 mw unit.

THE C-E CONTROLLED CIRCULATION STORY

Total capacity ordered, as of year-end 1960.....	26,300 mw
Total capacity in service, as of year-end 1960.....	16,421 mw
Capacity ordered in 1960.....	3,055 mw
Capacity placed in service in 1960.....	3,108 mw

THE C-E 2400 PSI STORY

Total capacity ordered, as of year-end 1960.....	12,185 mw
Total capacity in service, as of year-end 1960.....	6,093 mw
Capacity ordered in 1960.....	2,250 mw
Capacity placed in service in 1960.....	2,266 mw

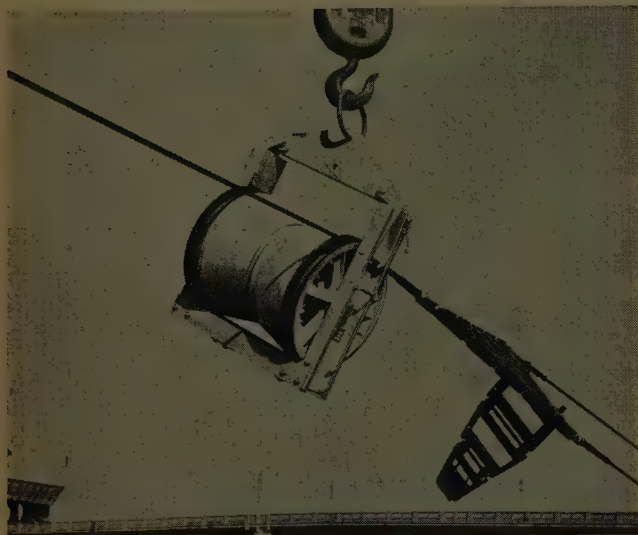
COMBUSTION



ENGINEERING

General Offices: Windsor, Conn. • New York Offices: 200 Madison Avenue, New York 16, N. Y.

C-307



On angles, when the pulling line slips into the conductor sheave, as above, the wedge-shaped running board will force the block to center and conductors will be placed in the outside sheave grooves without interruption of pulling operations.

Single-Line Pulling of Multiple Conductor Simplified

To meet the need for new equipment to overcome the problems of stringing multiple conductors with a single pulling line, an articulated running board and bundle block which works as a team has been developed by Sherman and Reilly.

The running board conforms to the outside diameter of the center drum and conductor sheaves as it passes through the throat of the bundle block and holds the lift on initial contact to a minimum. The 1-inch lift causes a minimum of forward swing and eliminates the need for tie back ropes.

The counterweight is articulated also for easy passage and is restrained from swinging beyond the horizontal plane of the board. It adds stability to the board and prevents rotation.

Even on angles, where the pulling line might slip into the conductor sheaves, the wedge-shaped board will force the block back to center and place the conductors in the sheaves properly.

Thermoelectric Generator Goes Commercial—For Gas Industry

A manufacturer of gas furnaces is the first to pounce on the thermoelectric generator for commercial use as a solution to many a gas company

problem . . . what to do when the power goes out during a winter storm.

In the past, home owners and businesses using gas furnaces in time of power outages had to operate their furnaces manually, if they knew how, or get along without heat. The application of the thermoelectric generator eliminates this problem.

The thermoelectric unit, installed in Luxaire heating units by the C. A. Olsen Mfg. Co., was demonstrated at the recent 15th Annual International Heating and Air Conditioning Exhibition in Chicago.

During recent tests, the unit produced 130 watts of power at approximately nine volts. Heating capacity of the furnace is 80,000 Btu.

Choose Air-Magnetic Breakers For TVA Project

Contracts for three 13.8-kv stored-energy air-magnetic circuit breakers, with the highest interrupting and closing capacities ever afforded in units of the type, have been awarded by TVA to I-T-E Circuit Breaker Co.

Scheduled for delivery early this year, the breakers will have 1500-mva interrupting ratings and 100,000-ampere closing capacities. They will be installed at the Wheeler Dam power station.

Previous air-magnetic breakers have been available only up to 1000-mva interrupting and 80,000-ampere closing ratings.

Dow Compound Speeds Motor Insulation

A faster method of insulating sore thumb connections in form wound motors has resulted from development of a new rubbery silicone adhesive called Silastic RTV 731. Manufactured by Dow Corning Corp., the compound is simply squeezed from its collapsible tube into the molded connector caps and the caps installed over each coil connection. Within 24 hours, the compound cures at room temperatures to a rubbery solid and becomes an integral part of sealed silicone rubber insulation systems.

TRW Doubles RW-300 Memory Capacity

A 16,000-word magnetic memory drum for the RW-300 digital control computer has been announced by TRW Computers Co., a division of Thompson Ramo Wooldridge Inc. The new drum greatly expands the capabilities of the computer which to date has logged 200,000 hrs of operation with a reliability record of better than 99 percent.

Big 3 Reiterate Positions; Pledge Open Competition

While electrical equipment manufacturers were busy setting their houses in order after the recent anti-trust actions, the eyes of the nation turned to electric utilities, the Federal government, state and municipal buyers to see what the next step would be.

Although the companies hold to their corporate innocence, by their guilty pleas in a limited number of product lines, they are legally liable for damages suffered by customers.

To confer with utilities and other buyers of heavy equipment regarding questions arising out of the anti-trust proceedings, GE has recalled Charles E. Wilson, who retired as its president in 1950 and who has an outstanding record of government service. On a similar mission, Westinghouse has named George L. Wilcox, former president of Canadian Westinghouse, vice president and assistant to the president.

Specifically, Mr. Wilson will head up cooperative studies with customers to determine if violations of the anti-trust laws by certain employees has been financially detrimental. According to Ralph Cordiner, GE Chairman, the company is doing this voluntarily to meet its responsibility, just as it backs up the products it makes.

Mr. Wilcox will undertake special assignments on domestic and foreign competition and customer relations, including specifically the problems left as an aftermath of the proceedings.

The Big Three (Allis-Chalmers, General Electric and Westinghouse) have repeatedly asserted no knowledge of misdoings on the part of employees and officers involved in the scandal. They have assumed responsibility for any damages which may have accrued to customers, however, and have set about to make sure that a repetition of the actions will not occur again.

Both Allis-Chalmers and Westinghouse now have legal department sections charged with making sure that all members of management are aware of the extent of anti-trust laws. The A-C legal department has operated in this area during the

(Continued on page 117)

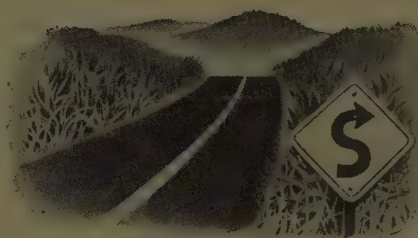
AMCHEM, the makers of Weedone, can solve your brush problem...whatever it is

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Turn brush-choked utility rights-of-way into brush-free areas quickly and economically with WEEDONE/WEEDAR brush control chemicals. Also now available—complete brush control programs through new "dormant cane broadcast spraying" techniques.

ROADSIDE CLEARANCE



New AMIZINE Weed Killers and AMIZOL combinations provide complete vegetation control along thousands of miles of roadsides, center strips, embankments, guard rails, etc.

RIGHT-OF-WAY CLEARANCE



Specialized Amchem techniques using WEEDONE/WEEDAR chemicals and AMIZINE/AMIZOL combinations provide high control, low cost chemical brush eradication programs for railroads.



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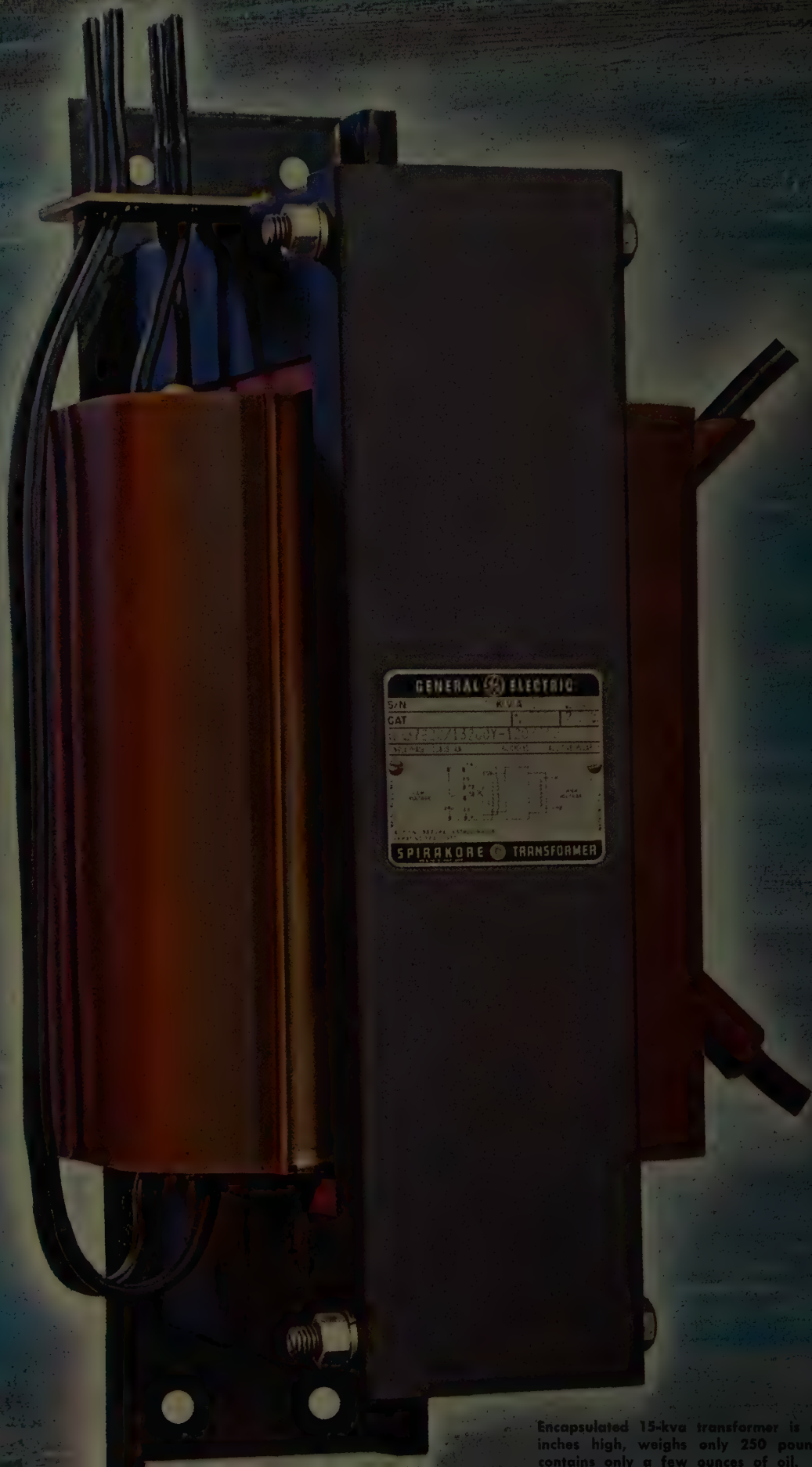
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AMCHEM PRODUCTS, INC., Ambler, Pa.

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BREAKTHROUGH!



GENERAL ELECTRIC
S/N R.V.A.
CAT
15/13200Y-150
VOLTAGE 13.8 kV ALTERNATING CURRENT
CIRCUIT DIAGRAM
SPIRAKORE TRANSFORMER

Encapsulated 15-kva transformer is only 24 inches high, weighs only 250 pounds and contains only a few ounces of oil.

General Electric reports on one of the most important distribution transformer developments in 75 years

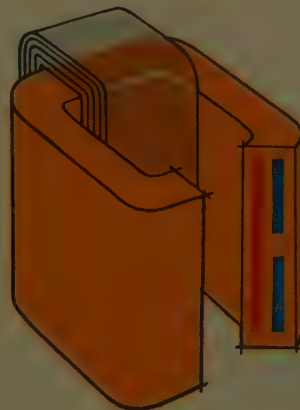
Take a close look at *this* distribution transformer . . . it's the first not to use oil for insulation and cooling since Elihu Thomson applied for patent on his oil-filled design in 1886!

It's General Electric's revolutionary new *encapsulated 95-kv BIL transformer*. And though still developmental, it promises important new advantages to help utilities meet the high-load demands of the decade ahead.

The keys to this dramatic innovation are a special epoxy resin and advanced methods of encapsulation that provide high dielectric strength and efficient heat dissipation. Transformer tank, paper layer insulation and all but a thin film of oil around the windings have been eliminated. Result: a distribution transformer 25 percent smaller and significantly lighter than present-day designs—and vastly more versatile. A few of its possible future applications are suggested at the left. There are many more—some as yet undreamed of!

Extensive research and application development are now underway to explore ways in which this important innovation might best be exploited to your full advantage. Such research typifies the unseen *extra* value you get when you specify General Electric—*pioneer of new ideas in power distribution!* General Electric Company, Schenectady 5, N. Y.

482-22



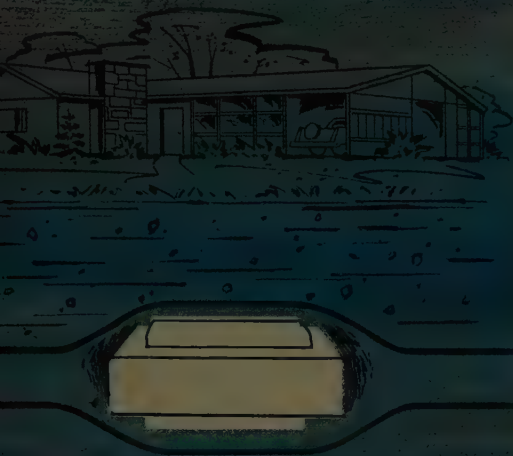
- EPOXY RESIN
- L-V WINDING
- H-V WINDING

Progress Is Our Most Important Product

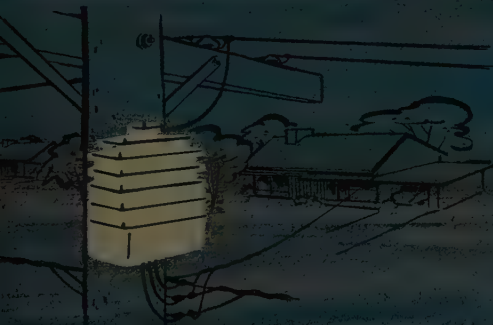
GENERAL  ELECTRIC



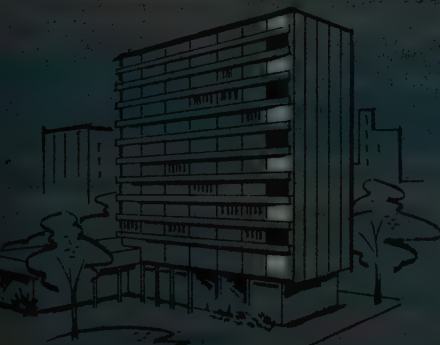
G-E prototype could be the forerunner of a complete unit residential package containing transformer, disconnect switch and meters.



Inherent reliability of revolutionary design may permit direct burial with cables to achieve the ideal underground system.



Compact design of new G-E transformer could make possible substantially smaller, lighter pole-mounted units.



Elimination of combustible liquids could allow units to be safely installed close to the load in high-rise apartment buildings.

Developments Announced By Manufacturers

Announcement of the development of practical encapsulated transformers by a number of manufacturers last month has raised the question of just how good this type of transformer is, when it will be available for large-scale use, and how this will effect the industry.

To obtain answers to these and other questions, **ELECTRIC LIGHT AND POWER** has surveyed some of the manufacturers in the field. The result: Interesting opinions, reports of research developments, but not much more.

Problem is, while research projects in the encapsulation of transformers has produced successful operating transformers, no units have as yet been in operation long enough to produce data to answer all the myriad of questions which must be answered before the units can be put in general production.

Research to Date

Some ten manufacturers are currently testing encapsulated transformers, either in their own research facilities or in conjunction with one or more utilities, installed in the utility's system. At least three other manufacturers are studying the subject to some degree, but as yet are not far enough

along to make any public announcement.

As yet, while almost all the manufacturers working on encapsulation projects hint at it, none has come out as saying that their product is ready for direct burial. Tests are being performed in this area, but results are not available over sufficient duration of service to be sure of long-term performance. From all indications, it may be some time before this goal is reached.

The majority of encapsulation projects to date are for either pole-top or above-surface mounting. General Electric is making about 100 of their new units available to selected utilities for testing during the coming year. Moloney Electric has already installed its first encapsulated wall-mounted transformer on the system of an eastern utility. Others have been conducting tests in their own facilities. To date, in all cases, the results are promising.

Problems to Overcome

Before encapsulated transformers will become stock items, there are a number of problems to be overcome. First, proper cooling must be assured to prevent accelerated deterioration. This is true for surface-, above-surface-mounted units, or underground units. Second, the effect on the

transformer of earth surrounding a buried transformer after the earth has been completely dried-out and utilized as the means of dissipating the transformer heat must be calculated. Third, long-range costs must be computed, so that the decision can be made as to whether or not it is economical to use the one-transformer-per-residence concept. Since there is no overload capacity built into the encapsulated transformer, it will be necessary to make a long range prediction as to the maximum load to be

(Continued on page 113)



Relative sizes of the conventional Line-Material oil-immersed transformer and new encapsulated transformer are shown. Encapsulated transformer is at left.



Moloney Electric Co. has designed an encapsulated transformer which has undergone a number of underground tests to date. First utility installation will, however, be a wall-mounted unit.



General Electric's encapsulated transformer uses a special epoxy resin and eliminates all paper insulation and nearly all oil from core and coil. Units are 25 percent lighter and smaller than conventional transformers.

Encapsulated Transformers . . .

(Continued from page 110)

installed in the residence at any time during the life of the transformer. Either that, or the savings in original installed cost must be great enough to make it worth while to dig up the transformer in five or six years to install one with larger capacity. Fourth, terminations at the transformer must be tested further to make certain of strength and continuous solid insulation. One solution to this last problem may be making the termination at the transformer in the factory, and shipping the unit with 50- or 100-ft leads for connection to the primary above ground. Secondary leads may be handled in the same way.

Status of Encapsulation Projects

All the manufacturers have stated that to date their encapsulation projects are still in the development stage. Following are descriptions of the individual projects as of this time:

Allis-Chalmers has been working with epoxy encapsulated transformers for 10 years and claims a record of more of these transformers produced than the rest of the industry combined. According to a spokesman for the company, the biggest problems to overcome con-

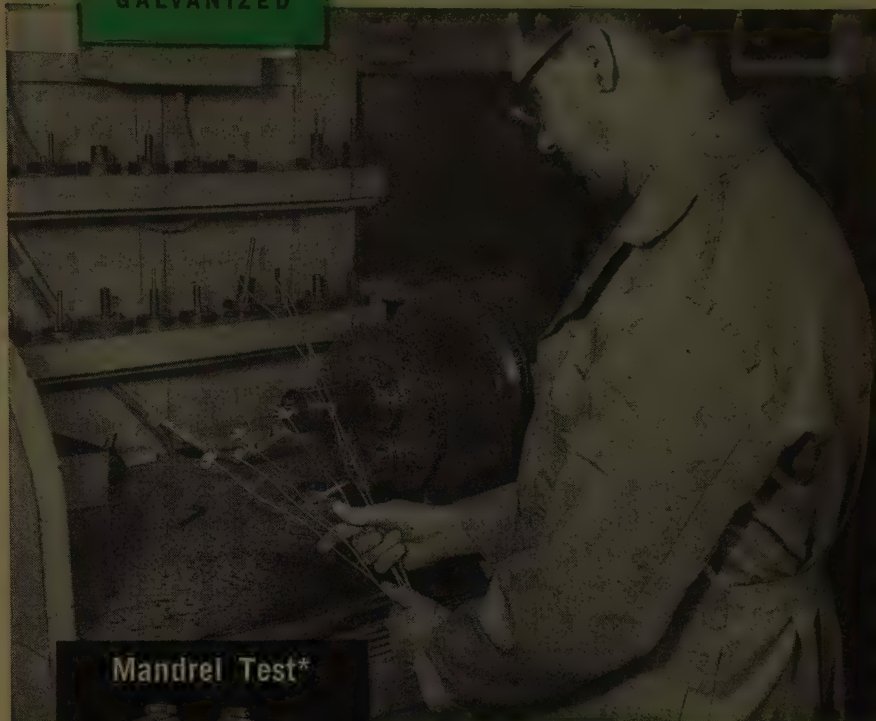
(Continued on page 114)

Pennsylvania Transformer encapsulated unit shown is rated 5 kva. It is designed for pole-top use. Bushings are cast in place.



Crapo
GALVANIZED

STEEL STRAND



Mandrel Test*



Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind *Crapo* Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

AVAILABLE IN 3 COATING WEIGHTS FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.



*Determines ductility of wire and adherent quality of galvanizing.

INDIANA

STEEL & WIRE CO., INC.
Muncie, Indiana

Encapsulated Transformers . . .

(Continued from page 113)

cern proper terminations at the transformer and coordination with related equipment. They have forecast that complete transformer burial does not seem to be too far in the future.

General Electric Co. recently announced the development of 15- and 25-kva units which are 25 percent smaller and lighter than comparable conventional oil-filled transformers. While G-E officials believe that future potential applications of the transformer will include direct burial, initial application will be in a unitized residential package, including the transformer, loadbreak disconnect switches, meters, etc.

The new transformer retains the full dielectric strength of conventional oil-filled construction because the high-voltage winding is impregnated with a small amount of oil (less than one-pint for the 25-kva unit).

All solid materials in the encapsulated transformer are capable of working well above Class A limits. The encapsulation, employing a specially-formulated epoxy resin filled with finely divided silica, provides the necessary heat transfer characteristics. This silica-filled epoxy also provides a good match of the thermal expansion coefficient with that of the other components of the encapsulated transformer. The units are rated at 80C average winding temperature rise. Pending results from field installation tests, there are no plans presently for making the encapsulated transformer design commercially available.

Line Material Industries is in production with a line of encapsulated transformers after a six-year development and testing program and will soon be offered to selected utilities for further evaluation under actual operating conditions. Present units are rated 15 kva, 2.4 through 7.62 kv. The L-M units are designed for above-surface installation.

The units are designed around company's Round Wound® core-

and-coil assembly, encapsulated in an epoxy material specially designed to provide high resistance to weathering and sunlight, high dielectric strength, and good heat dissipating qualities.

Moloney Electric Co. refers to their encapsulated transformer as disposable. They have been working in this developmental area since 1953 and in 1957 applied their technology to distribution transformers. In 1959 these encapsulated core-and-coil units were installed underground, where they were subjected to a continuous bucking heat run. Since that time, Maloney research and development personnel have periodically measured both the temperature of the units and the temperature of the surrounding filler.

The company has joined together with several utilities in various parts of the country for continued encapsulation studies and experimental programs directed toward finding the answer pertaining to installation costs, methods of application, and proper designs for various types of systems. First installation of a Moloney encapsulated transformer has been completed on the system of an eastern utility. It will be a wall mounted unit.

Pennsylvania Transformer Division, McGraw-Edison Co. research and development programs have indicated that oil-less, encapsulated distribution transformers will eventually replace tank contained, oil-filled transformers on both overhead and underground distribution

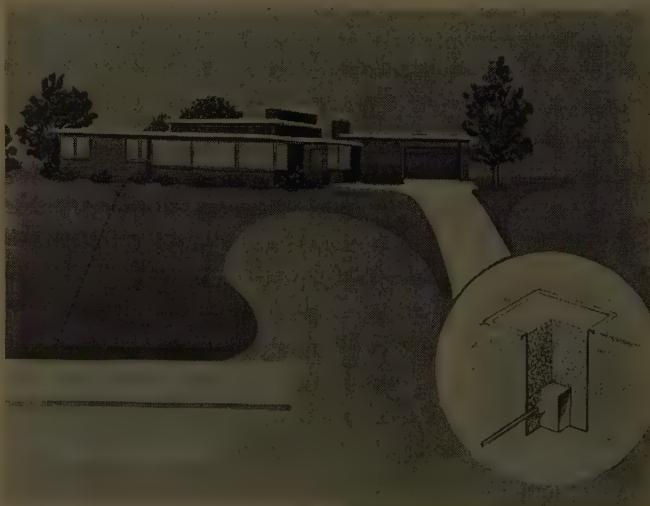
systems. Recent Pennsylvania Transformer prototype units consist of core-and-coil assemblies encapsulated in modified epoxy, accomplished by a vacuum-pressure method. Tests conducted to date include impulse, heat cycling, and weather exposure. Operational data obtained over the past two-years experimentation is now being studied in preparation for initial production models.

Westinghouse Electric Corp. has hit upon a slightly different solution to the problem. The most recent design on test is a dry-type transformer for single residence installation.

The installation requires an open tank with the top set just at the surface of the ground. The small transformer (about the size of a brief case) is placed in the tank. High and low voltage cables are connected through sealed connectors in a grounded sheath.

The open tank is then filled with thermal sand, providing a power supply for the residence that is both safe and out-of-sight. The installation can be water cooled economically if desired by connecting it to the residential water supply. It has, therefore, tremendous heat absorbing ability and can carry extreme peaks of load.

Others currently working on encapsulated transformers, in various stages of development, include **Central Transformer Co., Federal Pacific Electric Co., Kuhlman Electric Co., RT&E Corp., Standard Transformer Co., R. E. Uptegraff Mfg. Co., and Wagner Electric Corp.**



In residential installation, Westinghouse dry-type transformer is buried in an open vault and covered with thermal sand. Transformer itself is about the size of a brief case and can handle extreme temperatures and high peak loads.



Part of the multi-million dollar computer center at East Pittsburgh is shown, with the visitor's lobby at left. The center will serve Westinghouse research, sales, design engineering, manufacturing and accounting departments.

Westinghouse Dedicates Computer Center

Westinghouse Electric Corp. has dedicated one of the nation's largest and most advanced computer centers at its plant in East Pittsburgh.

The center is three times as large now as when it was originally started in 1955.

Equipment installed at the research facility includes an IBM 7090 computer, Remington Rand Univac, two IBM 1401 computers, an automated data plotter and data transmission devices. The engineering computer facilities also include three large-scale analog computers used for simulation of electric systems.

According to A. C. Monteith, vice president, apparatus products, "With this equipment it is now possible for Westinghouse to pursue a total systems approach through integrated data processing functions to serve research, sales, design engineering, manufacturing and accounting."

Programs already in operation at the new center include engineering design and application studies for a wide range of products from nuclear reactors and turbine generators to small motors.

"With several million dollars worth of the most modern equipment on the market today, we have assembled a combination scientific-commercial data processing second to none in industry," Mr. Monteith said. Mr. Monteith explained that the East Pittsburgh installation is

one of the first in the country to combine both scientific and commercial work in the same integrated program.

The expanded center makes it possible to take direct transmission of customer requirements from sales offices throughout the world, prepare engineering specifications, write the shop order, check inventory, schedule production and prepare invoices. "Under this system," Mr. Monteith stated, "Westinghouse engineers anywhere in the country will be able to transmit data to the center in the morning, get answers back, change their data, and get a second set of answers the same day."

Chance Moves Pittsburgh Manufacturing Facilities

To enable the company to realize greater production and marketing efficiency of their hardware line, A. B. Chance Co. has moved its entire production organization and equipment from their Pittsburgh, Pa., plant to Centralia, Mo. Announcement was made by L. C. Hansen, vp and general manager of the Chance Products division.

To fill in the void left by the movement of the Pittsburgh facility, a new ServiCenter has been constructed in Erie, Pa., to give sales, product application, and shipping services to the area.

(Continued on page 117)

Now—Convert your own
Reel Dolly to a
Bullwheel Tensioner
WITH A
PENGO
5000-U Assembly



5000-U assembly installed by City of Medicine Hat, Alberta, Canada

Here's an easy way to build up a modern bullwheel tensioner at low cost—simply install a PENGO 5000-U Bullwheel Assembly to your old trailer or reel dolly. You'll have a tensioner with Neoprene-lined 26" bullwheels, capable of handling practically any distribution line stringing job at tensions to 2,000 lbs. at up to 4 mph.



Support arms, reel spindle with reel brake, and hand rewinding assembly. 2 1/2" spindle will handle reels to 75" diameter, 44" width unless reduced to fit your trailer.

Bullwheel and tension brake assembly may be purchased separately.



We invite you to write or wire for literature, prices—please address Dept. 28



PETERSEN
ENGINEERING COMPANY, INC.

Santa Clara, California

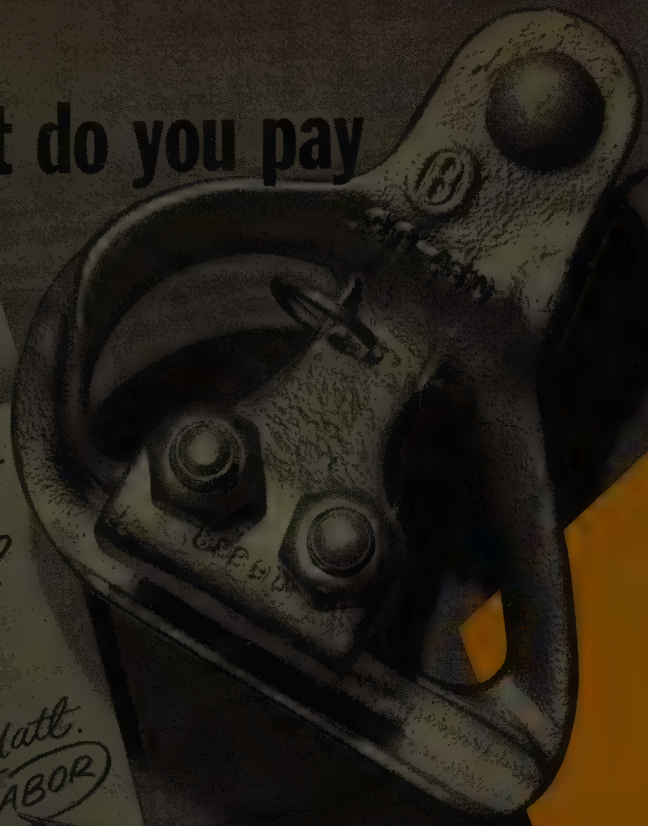
Phone: AXminster 6-7712

what do you pay for a clamp?

what about
OB 88500?

4.50
8.90
16.25
29.65
~~35.00~~ (LABOR)
65.00

all P1-2-2611
about clearance



**O-B universal
shows its actual
cheapness
when the last
lineman is
off the pole**

If you consider a distribution clamp all paid for when it is delivered to your storeroom, then certainly buy the cheapest one you can find -- we're out!

That clamp was bought to go on a line. It is just so many pounds of metal until it's installed. After installation, then just what *did* it cost? It doesn't take many wasted minutes of a line crew's time to change a quick saving into an equally quick loss.

Good design and manufacture enter the picture here. Parts that fit properly, threads that run easily, no loose pieces to drop -- in other words a minimum of tinkering and time-wasting -- are things that can make a clamp really cheap.

To the right are listed the principal reasons why the O-B Universal Clamp is an actual bargain. Installation time -- the most costly variable in any clamp -- is reduced. Preservation of cable life and strength is elaborately engineered into

vital parts. *On the line*, it is one of the cheapest clamps you can possibly buy. It must be in service before its proper cost can be computed.

Universal Clamps are stocked in most Graybar warehouses. You can get a few for trial by a telephone call. See what they actually cost when the last lineman is off the pole, and has assurance of staying off for a long time to come. Then you'll see what a low price really is.

OHIO BRASS COMPANY, MANSFIELD, OHIO

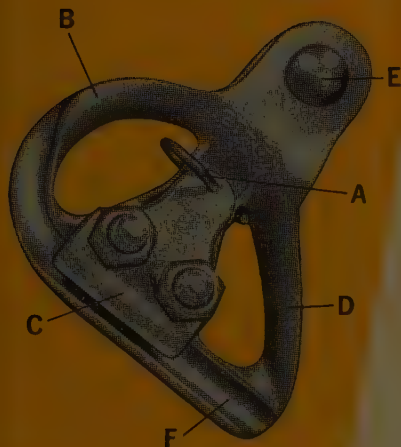
Ohio Brass®

HOLAND

10132-H



O-B Universal Strain Clamp, Number 88500. Range of conductor diameters, 0.20 to 0.50-inch. Ultimate strength, 10,000 pounds.



A. Spring-held keeperpiece. Stays positively open. Never dis-assembled. No loose pieces to handle or drop.

B. Snubbing action of clamp seat a major factor in high, slipless holding power.



C. Cable not crushed or deformed in clamp jaw. Gripped area may be relocated in span or jumper. Full strength and life of cable preserved.

D. Positive offset prevents chafing of cable where jumper loop crosses.



E. Hump-back, pointed cotter goes in and out easily with hot sticks but can't come loose.



F. Clamp brings cable into natural shape for jumper loop with minimum hand-forming.

Facilities . . . (Cont'd)



Equipment from the Pittsburgh plant of A. B. Chance Co. has been installed in this new addition to its Centralia, Mo., facilities.

Two large additions have been built onto the Centralia factory and other departments have been relocated or rearranged so that 58,000 sq ft of floor space was made available for pole line hardware manufacturing.

BIG 3

(Continued from page 107)

past year and results have been excellent according to a statement from the company. The Westinghouse legal department has only recently been delegated the responsibility for educating and enforcing in connection with anti-trust laws.

Pledge Fair Practices

All three companies have issued statements reiterating their belief in the free enterprise system and condemning unfair practices and collusion. They have made it clear that there will be no further cause for such anti-trust actions in the future.

Mark W. Cresap, Westinghouse president called upon 10,000 members of the company's management family "to make this (the company's policy of legal and ethical conduct) a living policy in every action we perform in behalf of Westinghouse.

"Under no circumstances should any Westinghouse man engage in any act that deviates from our policy—even though he may think that by so doing he is assisting the company in one way or another. Such a thought is but a delusion . . . Any such action is . . . and will be considered to be a deliberate act of disloyalty to Westinghouse, and it

(Continued on page 119)



Searching
for
Meter
Sockets?

look to . . .

SUPERIOR
SWITCHBOARD & DEVICES CO.

CANTON, OHIO

A Subsidiary of

The Union Metal Manufacturing Co.



Drawn Ringless Socket

Write for a free Catalog outlining types and sizes of meter socket equipment, test switches, test blocks, reactiformers and enclosures.

When this advertisement ran in February 1940, the Kerite generator leads had been operating 30 years. And they were still operating without failure when the turbo-alternators were dismantled in 1955 .. for a total of 45 years of perfect cable service.

BE GUIDED

*by facts, not claims
by service records,
not initial tests
by experience,
not prophecy*

The 11,000 volt generator leads on these Turbo-Alternators of the 59th Street Power Station of the Interborough Rapid Transit Co., New York City, are all single conductor braided

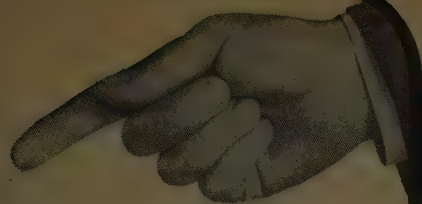
KERITE CABLES

INSTALLED IN
1909, 1910, 1911

They have all given and are still giving continuous and satisfactory service.

THE KERITE INSULATED WIRE & CABLE COMPANY INC.
NEW YORK CHICAGO SAN FRANCISCO





These KERITE cables

... were designed without any of the accurate methods now used to determine conductor size. They were overloaded throughout their lives, and although they were installed in brass pipes and operated at 11,000 volts, they were protected only with a non-conducting cotton braid.



1909

In 1946, one lead was removed, reeled, and shipped to the Kerite factory for investigation.

In spite of 36 years of thermal abuse, almost constant electrical discharge at its surface, and the physical handling involved in its removal and shipment, the minimum 60-cycle A.C. breakdown was above 90 KV with the average 10 KV higher.

Kerite engineers have pioneered improvements in almost every element of generator cable... but the consistently high qualities and long life of the Kerite insulation remain the same.



1960

THE KERITE CO.
30 Church St.
New York 7, N. Y.
Sales offices in principal cities.



BIG 3

(Continued from page 117)

will be dealt with in the future by appropriate disciplinary action," he stated.

General Electric said in a prepared statement that it believes the anti-trust laws should be aggressively enforced. "It has been, and will continue to be, the policy of the company to comply strictly with these laws with no exception, compromise or qualification.

"Although we accept in a constructive spirit justifiable criticism in this anti-trust situation, the assertions that it has been either business policy or alleged conformity to a supposed corporate way of life that brought about these violations of the law is not based on fact as far as General Electric is concerned. As the record well establishes, the actions of these few individuals were not in conformance with company policy, but a deliberate violation of General Electric directive policy and of the expected high standards of our corporate way of life. The acts were one of non-conformity and of conspiracy."

While there is obviously much to be done before any one customer can announce his intentions, it seems clear that damage suits *will* be brought against the manufacturers.

Whether or not the amounts of damages would reach anything like the astronomic figures mentioned in some circles is a good question, though early calculations seem to show that such would not be the case.

Possibly a question with even more potency was: How would the damages be paid?

Manufacturers have reassured their employees that companies would not be going out of business as a result of any payments required. But, some small manufacturers have expressed concern about the possibility that arrangements might be made for manufacturers found to have overcharged customers to repay such obligations in goods, rather than in dollars.

Obviously, this would have a further upsetting effect on the market for electrical goods.

for INSPECTION MAINTENANCE and SAFETY use the ULLMAN THUMB-ACTION RATCHET MIRROR

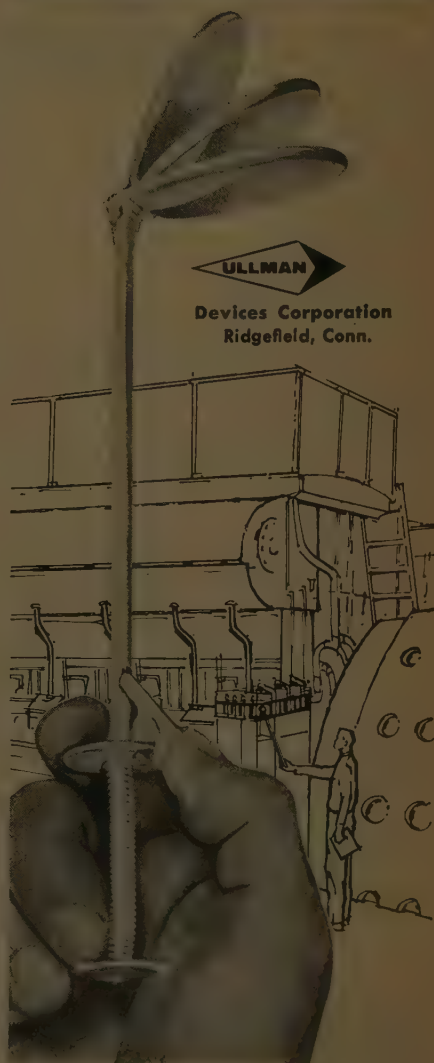
Easily adjustable to bring hidden angles into full view

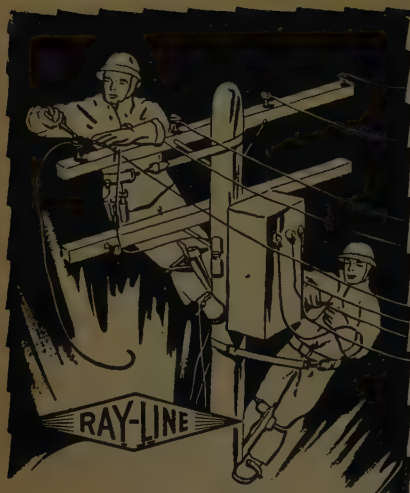
- One-hand operation
- Returns to straight position when thumb control is released

Precision Engineered
Throughout!



Devices Corporation
Ridgefield, Conn.





3 WAY EMERGENCY COMBINATION

All in one handy portable unit

Searchlight
Floodlight
and
FLASHING RED
WARNING LIGHT



Automotive
Roof Mounting
SEARCHLIGHT

Also other types

Red Warning
Light for
emergency
vehicles

Permanent and
Demountable
Types



SPOTLIGHT

operates from
vehicle or
portable battery.

Send for Bulletin No. 26

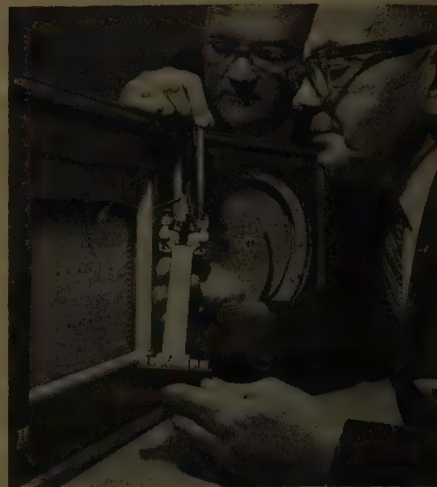
THE PORTABLE LIGHT CO., Inc.
63 PASSAIC AVENUE, REAR, N. J.



NEW PRODUCT DESIGN

Strain Gauge Adapted As Potentiometer Rebalancing Element

ElectroniK 17 potentiometer by Minneapolis-Honeywell Regulator Co. incorporates an extremely accurate, trouble-free, electro-mechanical strain gauge as the rebalancing element. Thus, the conventional slidewire is eliminated and infinite resolution is achieved. The number of points at which the potentiometer can come to balance is no longer limited to the turns on the slidewire. Initial production of the new potentiometer, which can be mounted in a standard 19-in. relay rack, on a panel or bench, or made portable, will consist of a single pen strip and circular chart recorders, and a circular scale indicator, each with or without control. In addition, all critical components are isolated within an electrical shield, thus rejecting stray signals; the unit has one true reference junction compensation



for all types of thermocouple actuation; and transistorized plug-in control units provide up to a maximum of eight set points for auxiliary or zone control.

Circle item #27 on reply card

Portable Tester Developed For Linemen's Gloves

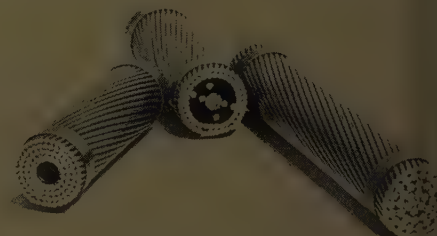


Linemen's gloves can now be tested right on the job with the E. D. Bullard Co. New/Matic Portable Glove Tester. The unit tests the gloves quickly, economically and efficiently and represents a major advance in rubber glove testing equipment. Until recently, there has been no completely satisfactory way to test rubber gloves daily for hairline cracks or pinpoint leaks. Testing can be done in three minutes. Glove is clamped over top of tester, hand inflated, and inspected. Tester comes in two sizes to fit all linemen's standard rubber gloves. Unit is of non-corrosive steel and carries a year's guarantee.

Circle item #28 on reply card

All-Aluminum EHV Conductors

Two new, unique electrical conductors have been developed by Rome Cable division of Alcoa for Bonneville Power Administration's 460-kv test line. Both are of all-aluminum construction. One design uses a rope-lay configuration 2.13-in. in diameter. The other employs a flexible aluminum conduit as the



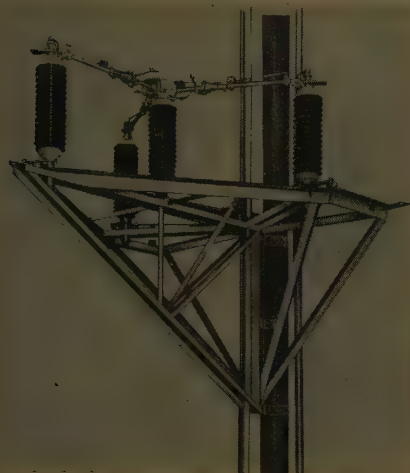
expanding medium. Neither uses any organic expanding medium.

Circle item #29 on reply card

Pole-Mounted Air Switch

A phase-over-phase, pole-mounted air switch is available from Southern States Equipment Corp. In one-, two- or three-way models, Pole-Pak air switch is available in 7.2- to 69-kv and continuous current ratings of 600 and 1200 amperes. Utilizing Type 57L Braidless air switches, the units are simple to install due to unique clamping bands; no drilling is necessary. One Pole-Pak can accomplish same switching function as three conventional three-pole switches.

Circle item #30 on reply card



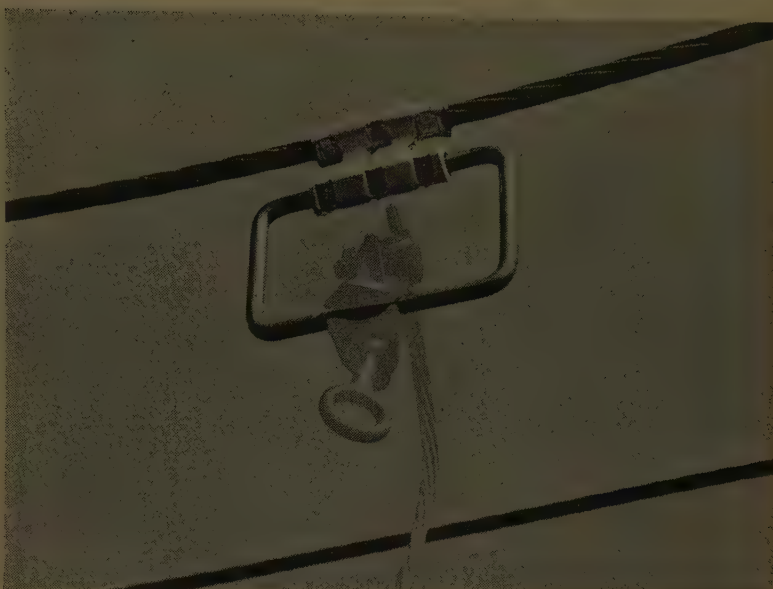
Cable Tracer

Faster and more economical tracing and identification of conductors in cables and conduits of control instrument installations is possible with the Amprobe Cable Tracer. Unit will trace up to ten conductors or pairs at one time, without need for buzzers, bells, or a helper. Less than 6-in. long, the unit is self-powered and permits one-hand operation. Available from Pyramid Instrument Corp.

Circle item #31 on reply card



SAFELY INSTALLED BY ONE MAN ...IN LESS THAN 15 SECONDS ...ON A 46,000 VOLT LINE



PATENTED

T&B-METHOD STIRRUP CONNECTORS and HOT LINE TOOL . . .

T&B-Method compression eliminates bulky bolts and screws . . . speeds and simplifies installation while giving you a more dependable, low-resistance joint. The T&B Stirrup Connector has a wide copper bail with enough clearance for two standard size hot-line clamps. Available plain or tin plated for #6-4/0 ACSR or stranded AL.

UT5E HOT LINE TOOL . . .

Interchangeable dies with built-in compression accuracy install the entire stirrup line, as well as splices, joints and compression tap connections. Tool is so well-balanced, it can be suspended from the cable when not in use. Just one squeeze of the handles for each compression. See your T&B Distributor, or write for Bulletin U1-27 to: The Thomas & Betts Co., Incorporated, Elizabeth 1, N. J. In Canada: Thomas & Betts Ltd., Montreal.

EASY AS 1 . . . 2 . . . 3 . . .

PATENTED

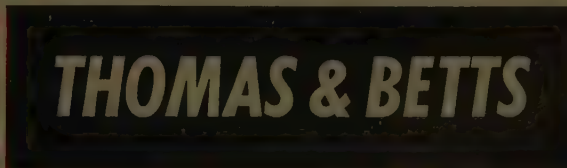


LOAD IT!

HOOK IT!

SQUEEZE IT!

Sold Coast-to-Coast Exclusively by Authorized T&B Distributors



NEW SANGAMO STACK RACK CAPACITOR EQUIPMENTS

put more kilovars in less space

Here's the newest Sangamo development in capacitor stacking units ...designed around the smaller and lighter Sangamo 50 kvar and 100 kvar capacitors. You get more kilovars in a given amount of space. For example, the new Sangamo stacking units with 100 kvar capacitors provide twice as many kvar as previous equipments, yet have the same length and height dimensions, and are only 12 inches wider.

There's a big weight reduction, too. Equipment weights with 50 kvar units are down 20 percent or more—those with 100 kvar units, down 25 percent or more.

You'll save money, time, and substation space by stacking your kilovars with Sangamo stacking units. Compact and light, they permit better use of premium space, require minimum footing, and are easier to mount. Need less maintenance, too, because of stainless steel capacitor cases, all-welded aluminum rack construction, high structural strength, and non-ferrous fittings.

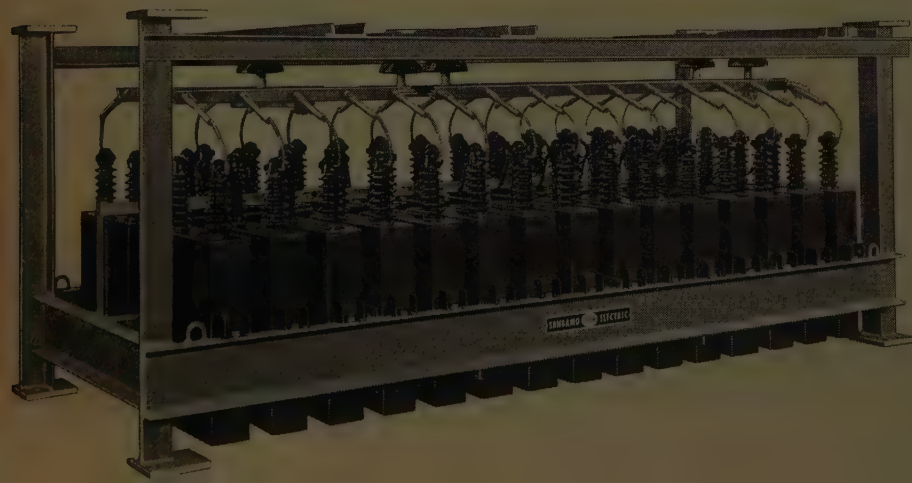
Remember, Sangamo equipments with 100 kvar units make it possible to use one rack where two were formerly required. This is especially important in 3-phase packaged substation equipments, and in some instances on large, high voltage stack rack installations.

Write us for further information.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



PC61-2



Tower Development

An octahedron tower with one-third greater load capability and six times greater torsional rigidity than conventional towers has been announced by **Up-Right Towers**. Towers utilize only two parts—identical struts and ball-shaped joints. Components are erected in prefabricated sections, which may be stored in stacks, about one-seventh the height of the assembled tower.

Circle item #32 on reply card



Narrower Capacitors

Allis-Chalmers "low profile" power factor capacitors are now narrower and lighter. 50 kvar units, rated 2400 through 7960 volts, measure about 25 percent less in width and are about 25 percent lighter. In addition, higher insulation levels are available. BIL of units 6640 through 7960 volts is now 95 kv where it was 75. In 2400 volt through 4800 volt range, BIL is now 75. The 25 kvar units have been modified in a similar manner.

Circle item #33 on reply card

Rectifier Stacks

Ultra-high voltage rectifier stacks up to 636,000 PIV are available from **Radio Receptor Co., Inc.** Shown above is assembly capable of delivering 600 kv at 20 ma d-c by means of Cockroft-Walton multiplier circuit. Each of the six air-cooled rectifiers consists of 26 ring-type hv units in series to give desired stack voltage. Each is rated at 97.5 kv RMS, 275,000 PIV, 20 ma d-c half wave capacitive load.

Circle item #34 on reply card



Pat. Pend.

EVER-GROUND

Provides constant grounding of moving conductors as they are pulled on a stringing job. The EVER-GROUND gives protection to linemen against accidental energizing of conductors, which could result in fatal injuries or severe burns.

EVER-GROUND snaps on the line at any point without a threading-through operation. High-contact rollers have Oilite Bearings—no oiling necessary. The large coil spring keeps the rollers in firm contact pressure with the moving conductor at all times, and permits the passage of splices.

Secure EVER-GROUND to cross-arm or reel with rope line. It will "float" on the moving conductor, keeping it constantly grounded.

Catalog #JT3, shown above, will take conductors from 1/16" to 1 1/2" diameter. Models available for all size conductors.

PAUL S. EVERLEY CO.

850 Ninth Street, San Francisco 3, Calif. • NElock 1-2295

NEW SMALLER LIGHTER



SANGAMO POLE-TYPE CAPACITOR EQUIPMENTS

Now, Sangamo pole-type capacitor equipments let you pack more kilovars into existing pole space. These new, all-welded aluminum rack equipments are more compact and weigh less because they are designed around Sangamo's smaller and lighter 50 kvar and 100 kvar capacitors. For example, the length of a 12-unit, 600 kvar rack with 50 kvar units has been cut by two feet, while its weight has been reduced by 20 percent over previous models. Still greater weight and length improvement is obtained with 100 kvar units. Reduced length and lower weight minimize both twisting and bending moment—make installation easier and lower in cost.

Sangamo pole-type equipments are available as both in-line and cluster mounts. Standard equipments with 50 kvar capacitors can carry up to 900 kvar in both types. Standard equipments with 100 kvar capacitors can carry up to 1200 kvar with the in-line rack; up to 1800 kvar with the cluster mount.

The in-line type has front-of-pole bracing to provide maximum climbing space free of grounds. 5 KV insulated stranded cable is used for unit and switch connections. Unswitched equipments have provisions for future addition of switches. All-welded aluminum racks, non-ferrous hardware and stainless steel capacitor cases keep maintenance costs down.

Write us for further information.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



AGAIN . . . Coffing Brings You a New Line of Hoists

The new Safety Pull Aluminum Ratchet and Pawl Lever Hoist is easy to operate—requires minimum handle pull. It may be operated from either side, and the design prevents freezing a load.

Safety has been built into the hoist. It will not ratchet under load if handle is released nor will it free chain. Controls are protected from inadvertent shifting. The bottom stop eliminates any hazard from the handle being released unintentionally. The exclusive safety handle bends to indicate overload.

Strength without excess weight in the new hoist is achieved by a special aluminum alloy which is used in the body and handle.

Available in six models with capacities from $\frac{3}{4}$ to 6 tons. Ask your distributor or write for Bulletin ADH-86.



COFFING HOISTS



DUFF-NORTON COMPANY

Four Gateway Center • Pittsburgh 22, Pa.

Frequency-zero . . .

(Continued from page 59)

Selling Safety Program

The benefits of a standards program can not be realized unless it is accepted by all and is followed as closely as possible. It is the responsibility of the supervisor concerned with the construction to see that standards books are kept up to date and to see that the phases of construction under his supervision adhere to the approved standards.

In addition to gaining uniformity in construction practices and aiding in safety programs, engineering standards are of great value in giving instructions to contractors who do work for the companies. Before the days of our present standards program, the appearance of a new contractor's crew on SWEP Co.'s property touched off a long period of constant engineering supervision in order to maintain any semblance of conformity with ordinary construction or safety practices by the contractor's crew.

Certainly, safe methods can not be determined and applied unless the job being constructed is fully understood. Only after the end result we want to achieve is determined, can the best procedures be laid out.

If we can get the idea across that engineering and safety are not in conflict with each other, but are both means to the same goal—namely, production in a safe manner, we will take a great step toward improving the over-all performance within our utility companies and toward frequency-zero.

Poor Planning Causes Accidents

Safe working procedures must be worked out to be applied during the original construction and for future maintenance of the job. These factors lead to a well-planned job that has no place in it for injuries because injuries are the results of mistakes and mistakes are the result of poor planning. And let us not forget that accidents consume time regardless of whether or not they injure people or damage property.

If you have an adequate engineering and construction standards program, you have a valuable and essential part of your safety program and may well be on your way to "Zero-Frequency."

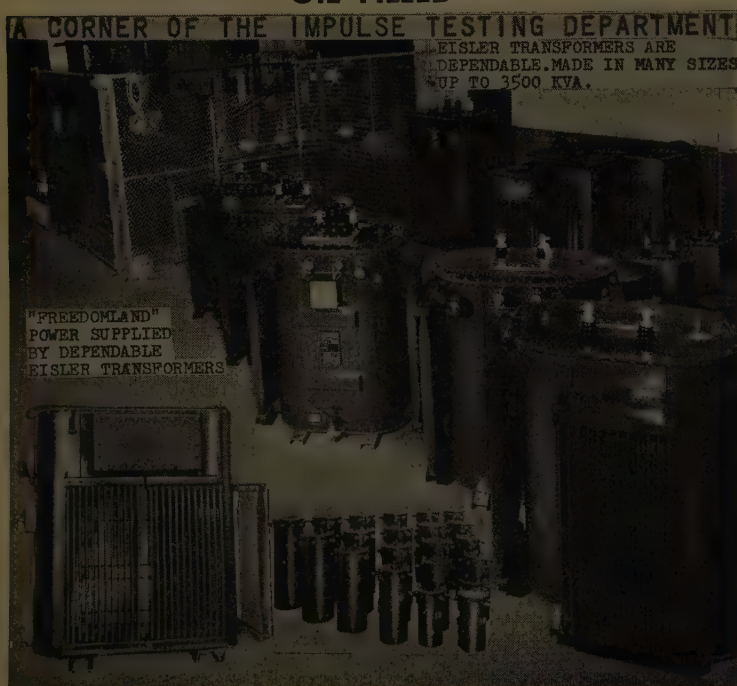
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Productivity Records . . .

(Continued from page 62)

should be assigned to six-man crews, and larger jobs should be assigned to six- or seven-man crews.

There is a feeling in the industry that it is most economical to do most line work with small crews since they eliminate the need for a non-producing foreman and reduce idle time inherent in some phases of many jobs. Our limited experience with three-man crews indicates that the crew leader is not fully productive as he must devote much of his time to directing work of the other crew members. Further, even in a three-man crew all crew members cannot work at all times. This is reflected in the high cost we have so far experienced with this size crew. We realize that a three-man crew can complete a fair size job but because of limited manpower it is frequently necessary for some poles to be climbed several times. We question the economics of this practice.

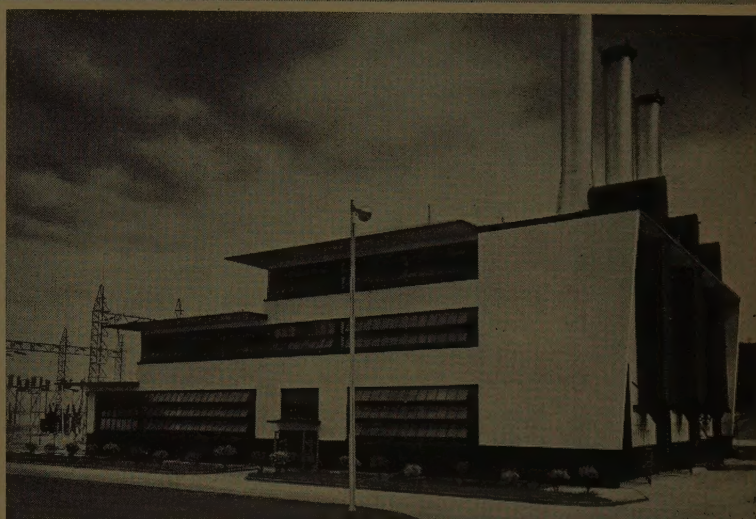
The only benefit to be derived from three-man crews on a system such as Union Electric's where most jobs are in the 100-manhour or over class is to relieve large crews of small jobs thus reducing their driving time and improving their productivity. Because of congestion existing on many poles in urban areas, a three-man crew frequently does not have enough manpower to do even a small job.

Preparation and justification of the annual budget has been greatly simplified by our work-reason system. All overhead line jobs are assigned one of the work reasons listed in Table III. All costs, labor and materials, broken down into construction, removal, operating and maintenance accounts are segregated by work reasons. Budgets are broken down in the same fashion.

Summary

Our measurement of overhead line crew productivity and performance is based on the productive manhour, and all cost measuring and control data is developed from this base. We believe that this is a sound approach and we are now extending the system to other T&D activities.

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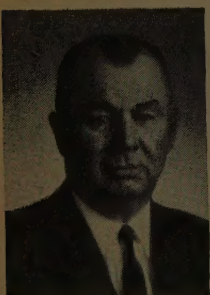
DESIGN • ENGINEERING • PROCUREMENT • CONSTRUCTION • REPORTS

Vice-Chairman, President Named at Southwestern P.S.

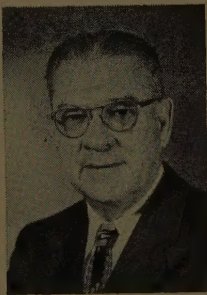
The promotion of two top executives at Southwestern Public Service Co. has been announced by H. L. Nichols, chairman of the board. John E. Cunningham, who has been president of the company since 1945, has been moved up to vice chairman of the board, and A. R. Watson has been named president of the Texas utility. Mr. Watson was formerly executive vice president.

Both men have been with Southwestern since its formation in the early '40s. They had both served with companies now merged to form Southwestern.

Mr. Cunningham entered the utility business in 1922 with the Edison Lamp Works. He joined Pennsylvania Power and Light in 1924 and transferred to Amarillo in 1927.



Cunningham



Watson

Mr. Watson was formerly president of Texas-New Mexico Utilities when that company became a part of Southwestern P.S. He was then named a division manager, and was elected vice president and industrial manager in 1947. He was elected executive vice president and general manager in 1953.

Combustion Names Grossi

Carmine J. Grossi, export sales manager of Combustion Engineering, Inc., has been elected a vice president of the manufacturing company.

It will be his responsibility to coordinate the relationships between the company's affiliates and licensees with its foreign sales department throughout the world.

Mr. Grossi has been with CE since his graduation from Georgia Institute of Technology in 1936.

SCE&G Appoints Two

South Carolina Electric & Gas Company has named a new vice president and has appointed another vice president to its executive committee.

President S. C. McMeekin recently announced that Treasurer C. M. Oyer, a veteran of 39 years in the utility business, has been named vice president and treasurer. He was also appointed a director of the firm and will assume the top financial post in the company, formerly handled by the late executive vice president, J. M. Costello.

Mr. McMeekin also announced the appointment of W. Judson Ready, vice president and controller, to the company's three-man executive committee, succeeding Mr. Costello in this capacity.

A native of Pennsylvania, Mr. Oyer began his utility career with the Pennsylvania Edison Company. From 1921 he served continuously in various financial posts with util-

ity firms in Pennsylvania and New Jersey until he joined South Carolina Electric & Gas Company in 1931. He has been treasurer of SCE&G since 1939.

Mr. Ready, who has held various accounting positions in the firm since 1925, was named controller in 1943. In 1952, he became a director, and in 1955, vice president.

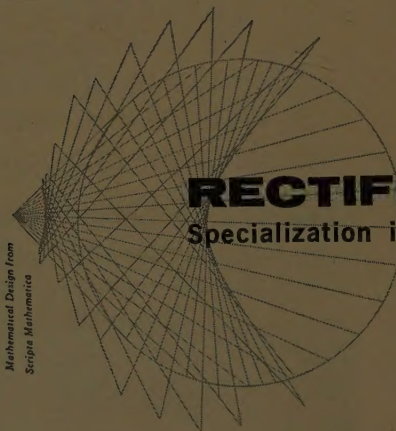
P.S. of Indiana Elects Swanson

Dwight H. Swanson has been elected a vice president of Public Service Company of Indiana. He will be in charge of the company's southern division with headquarters in Columbus, Ind.

P. A. McLeod, present division manager will continue in his present capacity until his retirement in June, 1962.

Prior to joining PS, Mr. Swanson was assistant to the system planning engineer at Commonwealth Edison Co. He is a Purdue University engineering graduate and served in various engineering and operating capacities with Commonwealth since 1948.

ELECTRICAL POWER BY DC POWER SPECIALISTS



RECTIFIER SPECIALISTS
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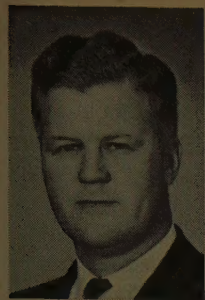
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Fargo Mfg. Elects V.P.



Stephen P. Becker, president of Fargo Mfg. Co., Inc., has announced the appointment of **Scott R. Wheaton** as vice president of marketing.

Mr. Wheaton has been with the company since his graduation from Duke University in 1951. Mr. Wheaton has served in a number of capacities with Fargo, the most recent of which was sales manager.

Men of Power Briefs

Robert E. Kettner has been appointed director of nuclear activities for Consumer Power Co.

The reorganization of the Saskatchewan Power Corp. electrical design division into four departments has brought about the promotion of three men: **Bernard Montbriand** will head the electrical distribution design department; **T. L. Bishop** the electrical transmission department, and **M. L. Bailey** the station design department.

Frank E. Kulman, senior engineer with Consolidated Edison Co. has been elected to the board of directors, National Association of Corrosion Engineers.

Three men have been promoted at Arkansas Power & Light Co.'s general office. They are: **H. F. Minnis**, vice president, who has been promoted to assistant to the president; **C. A. Clift**, vice president, who assumes full responsibility for divisional activities; and **W. Mills Murphey**, who has been promoted to executive assistant to the chairman of the board and the president.

MANUFACTURERS

The national Labor-Management Foundation has announced that a special award has been made to **Lemuel R. Boulware**, General Electric vice president, for his "intelligent and courageous approach to labor-management relations."

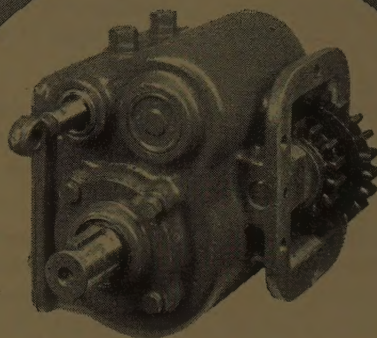
Alton W. Beck, Robertshaw-Fulton vice president, marketing, has transferred to the west coast as vice president, western operations. **Arthur G. Baitz**, former director of engineering planning, has become director of marketing.

Shannon C. Powers has been promoted to general manager of National Electric division, H. K. Porter Co., after nine years as general

manager of the Peerless Electric division of the Porter Co. He is succeeded by **Walter A. Curtis**.

C. M. Breder has been appointed manager, operations control for RCA data communications and custom projects department.

Leland M. Wallace has been named manager of street lighting sales at Revere Electric Mfg. Co.



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CALENDAR OF EVENTS

- March 16-17—Edison Electric Institute, Industrial Relations Committee, Mayflower Hotel, Washington, D. C.
- March 20-22—Edison Electric Institute, Sales Conference, Edgewater Beach Hotel, Chicago, Ill.
- March 21-23—American Power Conference, Sherman Hotel, Chicago, Ill.
- March 27-29—Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla.
- April 5-6—North Carolina State College, The South Atlantic Wood Utility Pole Conference, State College Campus, Raleigh, N. C.
- April 6-7—American Society of Mechanical Engineers, Management Engineering Conference, Statler-Hilton Hotel, New York, N. Y.
- April 6-7—Pacific Coast Electrical Association, Engineering and Operating Section, Ambassador Hotel, Los Angeles, Calif.
- April 10-14—American Society of Civil Engineers, Annual Convention, Westward Ho Hotel, Phoenix, Ariz.
- April 17-19—A & M College of Texas, Fourteenth Annual Conference for Protective Relay Engineers, College Station, Tex.
- April 17-18—Pacific Coast Electrical Association, Business Development Section, Sheraton - Palace Hotel, San Francisco, Calif.
- April 20-21—Edison Electric Institute, Industrial Relations Committee, Joint meeting with Personnel Administration Section, Southeastern Electric Exchange and the Southwestern Personnel Group, Roosevelt Hotel, New Orleans, La.
- April 26-27—Indiana Utility Association, Twenty-first Annual Young Men's Utility Conference, Severin Hotel, Indianapolis, Ind.
- April 27-28—Pacific Coast Electrical Association, Administrative Services Section, Villa Hotel, San Francisco, Calif.
- May 1—Interstate Power Club, Beverly Hotel, New York, N. Y.
- May 8-10—Instrument Society of America, 4th National ISA Power Instrumentation Symposium, LaSalle Hotel, Chicago, Ill.
- May 17-19—Pacific Coast Electric Association, Annual Convention, Sheraton-Palace Hotel, San Francisco, Calif.
- May 18-19—Pennsylvania Electric Association, System Operating Committee, Sky Top Lodge Hotel, Scranton, Pa.
- May 22-24—American Institute of Electrical Engineers, American Rocket Society, Institute of Radio Engineers, Institute of Aerospace Sciences, and Instrument Society of American, National Telemetering Conference, Sheraton Towers Hotel, Chicago, Ill.
- June 28-30—American Institute of Electrical Engineers, Instrument Society of America, American Institute of Chemical Engineers, American Society of Mechanical Engineers, Institute of Radio Engineers, Second Joint Automatic Control Conference, University of Colorado, Boulder, Colo.

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